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Part 2



BUSINESS COMPUTING
The Survival Guide



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Welcome to Part 2 of Business Computing: The Survival Guide. After having read Part 1 of this Guide most readers should now feel quite confident about buying a PC and know what to expect from it.

In Part 1 we covered various types of business software, a variety of computers (both IBM-compatible and non IBM-compatible), peripherals and communications.

It soon became apparent in Part 1 (sheerly by the small number of non IBM-compatible machines) that an increasing number of manufacturers are taking advantage of the wealth of MS-DOS software available and are competing in the IBM-compatibles market. Users and potential users are now becoming more aware of the computer market and will no longer buy a computer, no matter how good it is, if there is no decent software to support it.

Assuming you have now decided to buy an IBM-compatible machine, you are



now faced with the unenviable decision of which one?.

The 22 reviews presented in this Guide stand independent of each other and are as objective as possible. The aim is not to compare the machines against each other, but to present an intelligent insight of what each machine does or does not offer. This enables readers to make up their own minds according to their own individual requirements and preferences; a classic case of 'one man's meat is another man's poison'.

The rest of the guide is divided into three sections: finance, hidden costs and working with computers. A glossary is given to decipher any of the jargon that may have missed the editor's eye, and a suppliers' list gives details of whom you can contact for more information.

Part 1 of the Survival Guide is available at most newsagents. If you are having trouble obtaining Part 1, a copy may be secured direct from the Publisher by contacting Roula Tsitos on (02) 264 1266.

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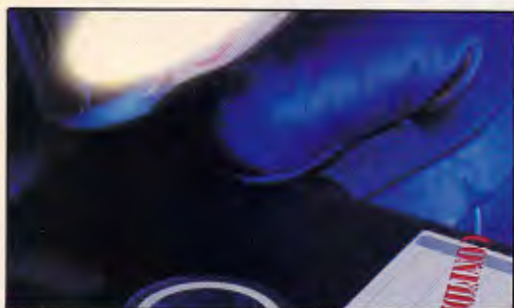
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Putting PCs in perspective

IBM-compatibles are not all the same — Ian Davies points out the differences to help you with your choice.

When IBM originally introduced its PC, some say it legitimised the micro-computer, others say it inflicted damage from which the progress of technology will not recover for a decade.

Either way, since IBM released its machine, the personal computer market has filled out in leaps and bounds. Both the hardware and software industries have blossomed with the effect that the end user, now has access to mountains of high quality software packages and cost effective hardware configurations.

In the beginning, people bought IBM PCs. Corporate purchasers, and others, assumed that IBM knew all about microcomputers, and that the IBM PC was on the leading edge of technology, a revolutionary development. Well, it was. But only from the marketing viewpoint. IBM actually had very little to do with its machine, and it was 12 months out of date when it was launched.

This was partially due to the 'open architecture' of the machine, meaning that the IBM PC was entirely constructed from third party hardware and software.

Due to this open architecture, other manufacturers began to utilise the same third party components to build compatible computers. Initially, the corporate sector was slow to accept the 'clones', but the offer of enhanced performance and lower prices eventually won over. Compaq was one of the first to gain acceptance in a big way and, in Australia, the Olivetti M24 was destined for great things.

Before long, virtually every hardware vendor started producing IBM compatibles. Companies such as Hewlett-

Packard and NEC who had initially tried to go their own way eventually succumbed to the irresistible force of compatibility. Of course, there's still Apple plugging away with the Macintosh, but the Mac can never hope to catch up to the software availability of the IBM architecture. For that is what it's all about — software availability.

Gradually, the PC buyer has become more sophisticated and, with that, more cosmopolitan. No longer is there a burning fear of all things non-IBM. The PC buyer in 1987 will happily buy a Compaq, Olivetti, DEC, NEC, HP, Sperry or any one of the hundreds of other brands, without concern. Even the Taiwanese machines are selling well among government and corporate sectors in the light of better support and irresistible prices.

As the competition increased and the IBM market share was threatened, it appeared almost as though IBM was conscious of what was going on around it. IBM took steps to catch up technologically. The hard disk based XT, the low price Jnr followed by the JX; the high performance AT; the portable; the laptop and finally the ATE all served to keep IBM only one or two jumps behind the leading edge.

But although IBM was a long way at the front of the parade, it could decide what tune the band would play.

While this is still true, the clone market has established itself as a major force to be reckoned with. Taiwan, in particular, looks like becoming the personal computer capital of the world. The discerning buyer no longer hesitates to look further afield than IBM. Indeed,

prowl the corporate corridors, it is now becoming more and more rare to see *real* IBM machines.

For this reason, we examine 22 IBM-compatible computers. Broken into three categories based on performance and physical size, this feature forms a indispensable aid to the prospective PC purchaser. Initially, we review some of the features to consider when making your purchase decision, and then launch into detailed investigations of each machine.

Processor

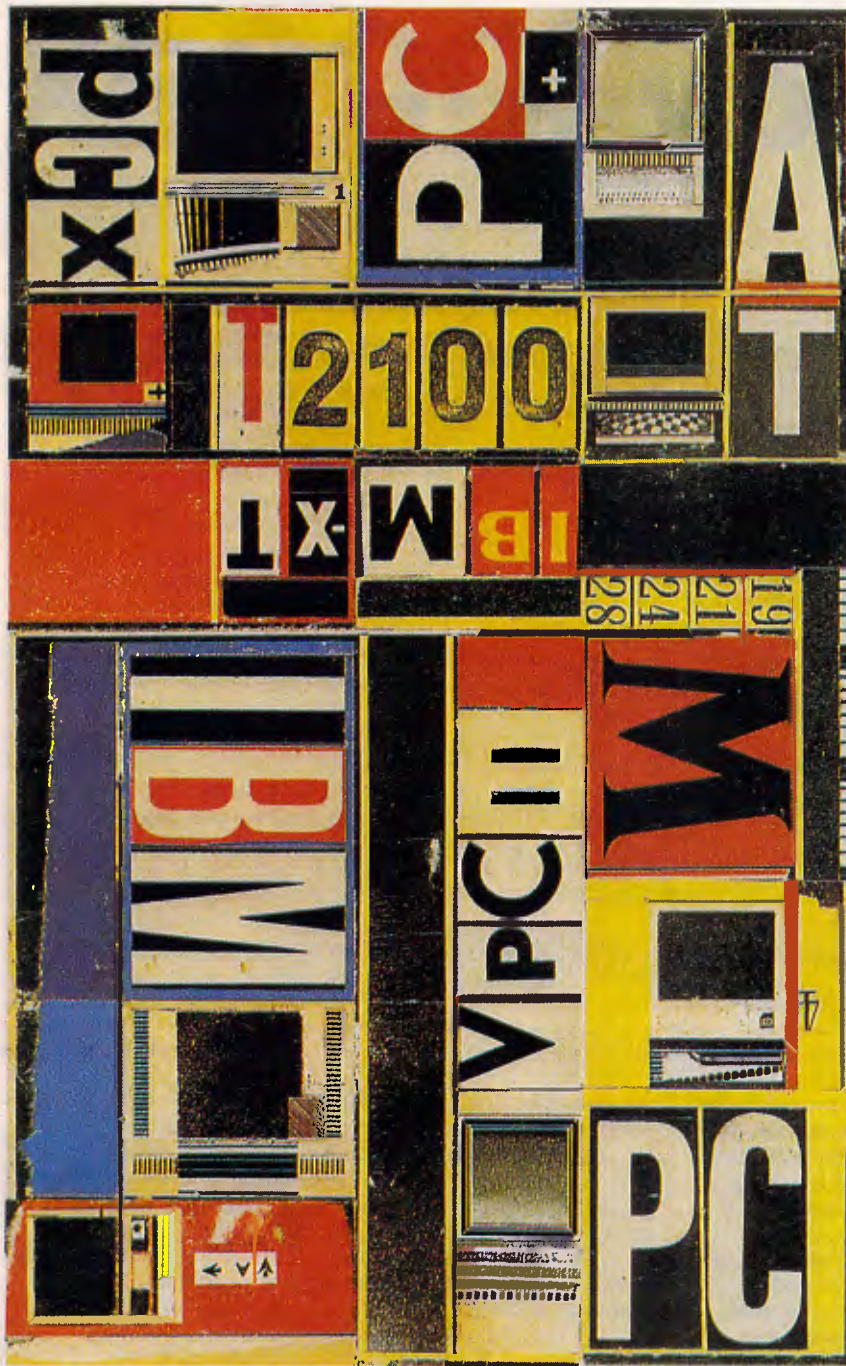
The central processing unit (CPU) of any computer forms the heart of the hardware system. The CPU carries out the programmed instructions, controls the hardware and generally determines the speed at which the computer will run.

There are several processors which may appear in an IBM-compatible computer; all of them either manufactured by a company called Intel, manufactured by someone else under licence by Intel, or designed by someone else based heavily on the Intel design and subject to on-going legal wrangles.

Broadly, two features characterise a processor. The *word size* determines how much information the CPU is able to move around at one time, usually 8, 16 or 32 binary digits (bits). The *clock rate* indicates the speed at which the processor is driven.

Both of these measures can become a little confusing, for example, the 8088 processor in the original IBM PC is a 16-bit processor internally which sees the

INTRODUCTION



world in groups of 8-bits. This means that the CPU performance is like that of a 16-bit chip for internal operations, but like an 8-bit device when memory or any other system resource external to the quarter inch chip must be accessed. These are known as 8/16-bit processors.

Similarly, many machines with high clock rates are provided with comparatively slow memory, and must wait every time memory is referenced. These are known as *wait states*, and can degrade system performance. Thus two 8MHz clock rate systems may not

provide the same level of performance.

The original IBM PC used an 8088 CPU running at 4.77MHz with no wait states. This chip is an 8/16-bit device, and so many compatible manufacturers started using the 8086, which is a true 16-bit processor. An 8086 running at 4.77MHz will go up to two times faster than an 8088 driven at the same clock rate, although in every day use, the improvement would be much less. Many vendors use 8086 processors running at significantly higher speeds. 8MHz is common, and speeds of up to 12MHz are not unheard of.

Variations on these devices include the 80186, which is basically an 8086 with more of the support components fabricated into the one package, and the 80C88 and 80C86, which are CMOS (low power) versions of the device and often used in portable machines. NEC produce the V20 and V30 CPUs, which are claimed to be significantly faster than the equivalent Intel chips, but usually only provide a 10 per cent improvement.

The 80286 processor is a 16/32-bit device used in the IBM PC/AT, and provides significantly higher performance than the 8088 and 8086, even when running at the same clock rate. Because this chip is so much faster, many 80286 based machines utilise wait states, although some manufacturers manage to eliminate memory wait states and thereby achieve higher performance. The 80286 has additional hardware built into it which can support multiple users, although this is quite rare in most applications.

The 80386 processor is the latest device from Intel, and is essentially a super minicomputer on a chip, outperforming many million dollar corporate machines. The 80386 is just emerging and, at the time of writing, only one vendor had an 80386 based machine on the market. The 80386 is the shape of things to come and offers unparalleled performance, but it is still quite expensive due to its relatively slow market penetration caused by the short interval between the 80286 and the 80386 release.

All of these processors are upwardly compatible with each other. That is, the details of exactly what CPU is in a machine governs only the system speed. Anything which runs on an 8088 will also run on an 80386, although the reverse is not necessarily true.

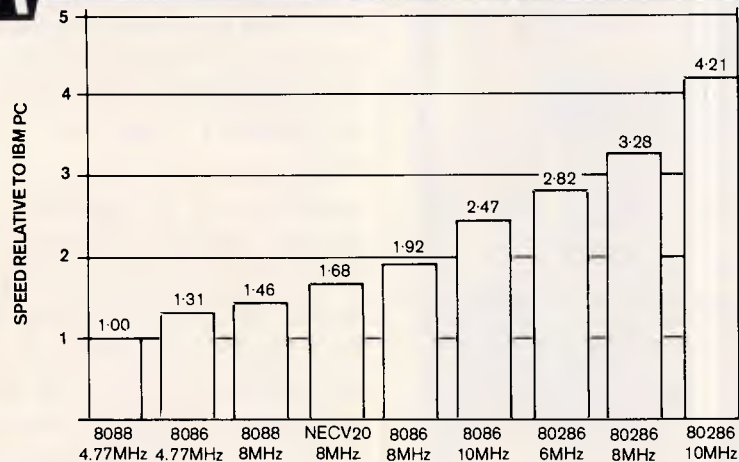
Memory

The prices and packing density of memory chips have improved dramatically over the last few years. Following usual technological trends, software vendors have utilised the enhanced availability of memory to make their software more powerful and to devote more attention to a high quality user interface.

These days, a minimum useful amount of memory is 256k (256 thousand characters). There are, however, many software products which require more than this amount and so 512k is probably a better choice.

The classical IBM PC/MS-DOS configuration has an inherent limit of 640k, although several schemes exist

RELATIVE SPEEDS OF IBM COMPATIBLES



This graph shows the relative speeds of typical IBM-compatibles, listed according to the type of microprocessor used. The speeds are measured relative to the speed of the IBM PC, so the IBM PC, on the left of the graph, is shown as having a speed of one. The IBM PC uses an 8088 microprocessor and a clock speed of 4.77MHz. Many other micros use faster microprocessors and higher clock

speeds. The graph shows how much faster other combinations are.

A computer with an 8086 microprocessor running at 8MHz (as used by the Olivetti M24 and Amstrad PC1512) is shown to be about 1.9 times faster than the IBM PC. At the extreme right is a computer with an 80286 microprocessor running at 10MHz and this is 4.21 times faster than the IBM PC.

which allow this limit to be bypassed. For most applications, any more than 640k of memory may be excessive.

Storage

All of the computers reviewed here provide floppy disks. These low cost, low speed, low capacity devices allow data and programs to be recorded on removable disks. There are two standard sizes, 5.25in and 3.5in. The 3.5in disks tend to be more robust and can provide a higher capacity, but are only an emerging standard. Although most software vendors are gradually moving to support 3.5in disks, there are still some software packages which are only available in the 5.25in format.

The 5.25in standard has two standard capacities, 360k and 1.2Mbytes. The higher capacity is usually only available on AT machines, and 1.2Mbytes drives are usually capable of also ready 360k diskettes.

A hard disk is a non-removable, high capacity, high speed form of storage, with usual capacities of 10, 20 or 30Mbytes. Two forms are available: *stepper motor* and *voice coil*. The stepping type tend to be low cost, but slow, whereas the voice coil cost two or three times as much but may perform two to four times faster.

Display

All of the systems described in this feature will provide a display adaptor which is compatible with one of the IBM or industry standards.

The usual display for extensive text work is the IBM MDA (Monochrome Display Adaptor). This adaptor is only capable of displaying text, but does so extremely well. For graphics applications, the CGA (Colour Graphics Adaptor) can provide both colour, graphics and text, but the text tends to be rather badly formed and is not really suitable for extensive text work such as word processing. Several vendors can provide a CGA display adaptor which drives a monochrome screen, generating 'grey scales' instead of colour. Other vendors have special CGA adaptors which are capable of generating well formed characters in text mode.

The enhanced graphics adaptor (EGA) is the latest IBM standard, and provides better colour graphics than the CGA while also performing well for text applications. The EGA tends to be very expensive and requires a high cost monitor. Whereas typical MDA or CGA hardware may cost under \$600, an EGA configuration would be worth over \$2000.

The final display adaptor standard is

the Hercules monochrome graphics adaptor (HMG). This is a de-facto standard, and most graphics software needs special modification by the vendors to support the adaptor. While many packages do support HMG, there are still equally many that do not.

Compatibility

Since you're thinking about an IBM compatible machine, one of the most important considerations is that it must really be IBM-compatible.

In the beginning, some compatible clones were slightly less than compatible. These days, however, most vendors seem to have got their compatibility problems sorted out and it is quite rare to see serious problems. Some vendors heading off on slight tangents do have problems with third party hardware expansion boards and networks, but as the industry sets itself more standards, these difficulties are also sorting themselves out.

In the current market, you can reasonably expect that any decent IBM clone will be capable of running all the major software packages, including WordStar, Lotus, Multimate, dBase, Norton, and so on. If you have any doubts, simply ask the vendor to demonstrate your intended software on his hardware configuration. If he starts to bluster, or dribbles technical terms, then there may well be some problem with his machine.

Support

One of the major reasons people have historically bought from IBM is support. Of course, unless you're a major company about to buy hundreds of machines, you can't actually buy a PC from IBM — you've got to visit one of its dealers. This does not detract from the support appeal of IBM, since even if the dealer goes out of business, IBM will not. Additionally, no one will ever say to you "You've got a what?"

Many of the compatible manufacturers are also large, respectable companies. Organisations like DEC, Olivetti, Televideo, Toshiba, NEC and Tandy are all forces to be reckoned with, and are unlikely to go down the gurgler, and probably unlikely to suddenly get out of the PC business. Even Taiwanese distributors like EME now have quite a convincing local support facility.

More and more, however, purchasers have options when it comes to support. Many computers are available with circuit diagrams, which is fine for the handymen. For the rest, it is almost getting to the point where computers are

"EPSON'S NUMBER ONE PRINTER DESERVES THE EPSON PC+."

James Dibble.



The Epson EX-800 is the number one printer from the world's number one printer company.

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A printer this good deserves something more than your average personal computer.

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INTRODUCTION

repaired like televisions. So many of these machines are essentially the same on the inside that experienced computer repairmen can work effectively no matter what the brand. Of course, this is something you would only resort to if the vendor went bust.

With many of the cheaper machines, the support worry almost fills out the window completely. When a clone is half the price of a real IBM, what does it matter if the clone breaks — throw it away and buy another — you're still in front.

PC systems

The humble PC style computer system is still probably the cheapest and most cost effective configuration available. These machines are desk top units, usually based on 8088 and 8086 processors, available in a wide variety of configurations and providing low to medium performance.

Around the low end of the market, many of the Taiwanese machines are available at incredibly reasonable prices. Moving up the market, named brands with presumably better support are available at higher prices. Some of the high performance PCs can actually run faster than one or two of the low end ATs.

Since PC technology is now so well established, and the market is so competitive, the end user benefits in the form of attractive prices.

AT systems

These systems are expensive, but the prospective AT purchaser has an all-consuming need for processing power. These boxes run 80286 processors at a variety of clock rates and almost always have hard disks, hopefully voice coils.

Buyers should, however, be on the look out for wait states which degrade performance below that of other machines with equal clock rates. Also, beware of high performance ATs with low performance hard disks such as stepper motor disks. This may not matter if your heavy application is entirely CPU bound, but since most business applications also tend to hit the disk pretty hard, these machines can be like a Porsche with a two speed gear box.

The AT is sometimes claimed to be a multi-user machine, and indeed it is if you run the right operating system, namely Xenix. However, the enormous library of software that everyone wants is available only under MS-DOS, availability under Xenix is far more restricted. For this reason, most ATs are used as fast single user MS-DOS machines, rather than multi-user Xenix systems. Of course, you can still network ATs under MS-DOS, and this may be the preferable way to go about it.

Portable systems

Most of the portable systems tend to be small PC-compatible systems. The price

goes up, because vendors must devote a great deal of energy to low power consumption, low weight and small physical dimensions. These are achieved through the use of exotic components and customised integrated circuits.

These small machines inevitably provide low quality displays, less expansion potential and more crowded keyboards than the desk top units. However, when what one needs is a portable machine, portable it must be.

There is a great deal of price variation in this range, as some vendors provide very good displays, expansion, better keyboards or size advantages. At the top end, the price may make a desk top PC pale into insignificance.

For the PC user on the run, the main criteria must be size and weight, followed closely by the usual quality, support and price.

Conclusion

The machines described in the following pages cover a wide variety of performance, configurations, vendor name and price.

When looking at these systems, it's worth bearing in mind that each vendor offers different features as standard equipment.

For most users, no single consideration will solely influence the purchase decision. For most, it will be a combination of power, reliability, support, reputation, features and price.

Benchmarks

Category	Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
PC	Amstrad PC 1512	0.2	0.8	2.0	2.0	2.2	4.2	7.6	6.2	3.1
AT	A*Star II	0.2	0.8	2.1	2.1	2.4	4.0	6.2	6.3	3.0
PC	Atlantis PC/XT	1.3	4.7	9.1	10.5	11.4	20.5	31.7	33.9	15.4
PC	Basic Time BTurbo	0.8	2.8	5.2	6.0	6.6	11.8	18.2	18.7	8.7
P	Bondwell 8	1.4	5.1	10.9	11.2	12.2	22.0	33.4	35.2	16.4
PC	Cleveland PC II	0.5	1.9	3.6	4.1	4.4	7.9	12.2	13.0	6.0
AT	Compaq 386	0.1	0.5	1.4	1.4	1.5	2.6	4.0	4.6	2.0
PC	Epson PC Plus	0.5	2.0	3.9	4.4	4.8	8.5	13.4	14.5	6.5
P	IBM Convertible	1.5	5.0	11.6	12.0	12.9	22.4	35.6	34.1	16.9
PC	IBM PC	1.5	5.2	12.1	12.6	13.6	23.5	37.4	35.0	17.6
AT	IBM PC/AT	0.8	2.2	4.9	5.1	5.6	9.4	15.0	13.9	7.1
PC	Kaypro PC	0.9	2.9	5.5	6.3	6.9	12.2	18.9	20.1	9.2
PC	Leading Edge PC	1.3	4.8	9.3	10.7	11.6	20.9	32.4	34.1	15.6
AT	Multitech 900	0.3	1.1	2.6	2.7	2.8	4.9	7.5	7.6	3.6
AT	NEC APC IV	0.5	1.5	3.0	3.0	3.0	6.0	9.5	9.5	4.5
PC	Olivetti M24SP	0.7	1.9	3.5	3.9	4.2	4.3	11.5	12.8	5.3
AT	Osborne PC/AT	0.6	2.1	4.2	4.4	4.7	8.3	12.9	13.1	6.2
PC	Profound PC/XT Turbo	0.8	2.9	5.5	6.3	6.8	12.3	19.0	19.7	9.1
P	Sotec/Datavue	1.7	5.5	11.2	11.5	13.0	14.0	36.7	33.7	17.2
AT	Sperry PC IT	0.7	2.0	3.8	3.9	4.7	8.9	13.3	10.6	5.9
AT	Tandy 3000	0.7	2.1	4.0	4.2	5.1	9.5	14.4	11.2	6.4
AT	Televideo Telecat 286	0.5	1.8	4.2	4.3	4.7	8.2	12.9	13.0	6.2
P	Toshiba 2100	0.9	2.8	5.7	5.8	6.6	12.0	18.4	17.4	8.7
AT	Zenith AT	0.6	1.6	3.2	3.3	3.6	6.2	9.8	10.0	4.7

Benchmark comparison of all systems reviewed.

DON'T TAKE A DRIVE FROM A STRANGER



Do you know which drives
are in the computer you're buying?

The last thing you want is a drive
that "picks up" your data and takes it
on a one way trip to Nowhere...

Don't risk being driven into purchasing
just any disk drive. Make sure you specify
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HOPEFULLY YOU'LL FIND OUR NEEDLE IN YOUR HAYSTACK



Finding the right business solution in computers these days is, to say the least, confusing and tiring. What with all of those questionable clones in the market promising the world for a song, it really makes you wonder who is in tune and who isn't.

— INFANT ITS COMPARABLE TO FINDING A NEEDLE IN A HAYSTACK —

"A*Star II" Your first & last computer is network ready The "A*Star II" is both a single and a multi-user system. As your needs grow the "A*Star II" grows with you. Unlike any other PC/XT/AT available, the "A*Star II" is factory equipped for multi-user operation. Simply snap in our low cost network adapter card and connect up to 254 other PC/XT's or AT's for fully transparent multi-user networking.

"A*Star II" — Faster than any "AT" available A 12 MHz CPU coupled with a 31.9 MBs (formatted), "Voice Coil" hard disk makes the "A*Star II" the fastest computer on anybodies desk. The standard memory is 1MB expandable to 16MB, more than sufficient for all of your needs, and a 1-2MB dual speed floppy drive will run your existing "XT" software admirably as well as all of your "AT" requirements.

Our keyboard is first class The keyboard boasts a full 'tactile feedback' mechanism. It will challenge the fastest typist to any test and will endure the tests of time.

Intelligent Design Places the hard disk and floppy disk controller on the main board, freeing an extra slot.

Power The power to move all of this is supplied by a 220 watt power supply. At least 20 watts better than the rest!

Documentation Unlike so many other 'clones', the "A*Star II" is fully documented with a system set-up disk, a users guide, a money back guarantee and a coupon redeemable for no charge schematic documentation.

Price Lets just say our Asian friends will have a bad case of hayfever this season.

Warranty The "A*Star II" is under full warranty for a period of 12 months. Further, at a small additional charge, a comprehensive insurance scheme will cover your system from theft through to data reconstruction costs.

Developing a computer so technically advanced to make the others obsolete takes time, money and years of experience. The manufacturer "Wells American" has placed its technology trust in KCM — because KCM knows technology and service.

WHEN YOU'VE DECIDED "A*STAR II" YOU'VE FOUND THAT NEEDLE IN THE HAYSTACK



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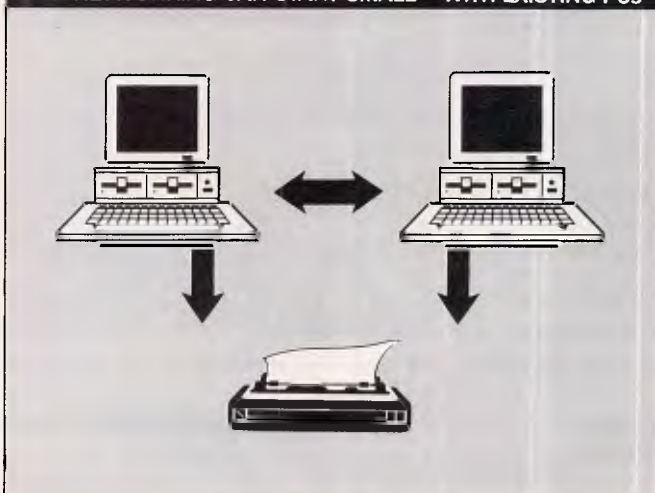
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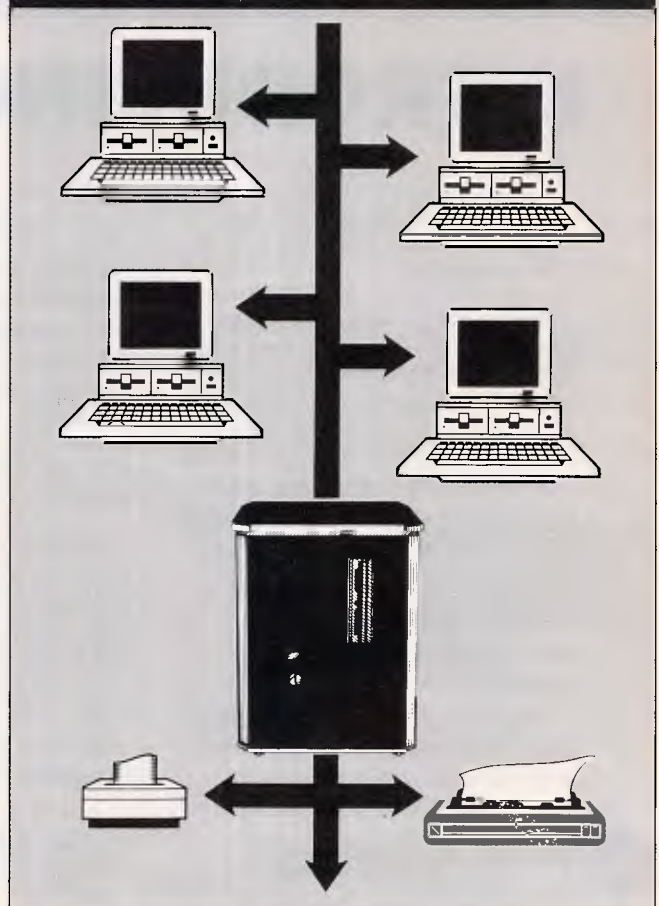
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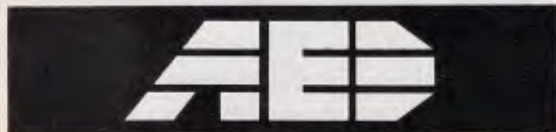
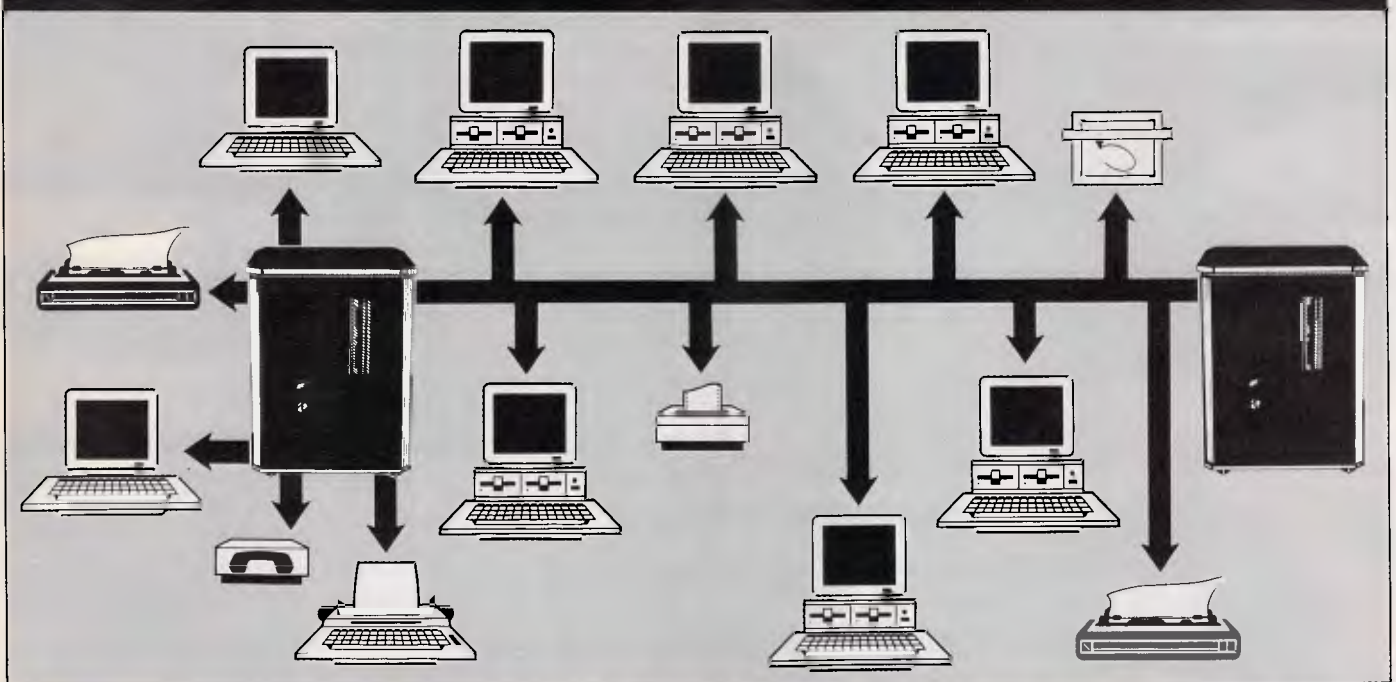
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Amstrad PC1512

Amstrad's new IBM-compatible PC is a surefire winner. It is a good choice for almost anyone who wants to buy a business micro — whether it is a first machine, an upgrade from a simpler system or one of a number of machines being bought to be used in a large company network.

The Amstrad PC1512 is a nicely-packaged IBM-compatible business micro, with a quick turn of speed and an attractive price — starting at around \$1450.

Amstrad has succeeded in putting together a very tempting package for the price. The PC1512 includes everything likely to be needed; monitor, lots of memory, graphics, DOS software, interfaces — even a mouse — in one box. The only thing missing is a printer.

In contrast, some cheap clones have only a very basic specification — just 256k memory, no DOS disks, no manual, no graphics and rarely a monitor. The suppliers will, of course, make up a full-specification machine (usually at an excellent price) but the buyer has got to know what to ask for and be prepared to pay for it.

Hardware

The Amstrad PC1512 is an attractive system which occupies around half the desk space of the genuine IBM article. The main unit is also surprisingly light because it takes its power from the monitor (which is consequently surprisingly heavy).

The construction is certainly far better than the delicate feel of Amstrad's PCW machines, although not as good as a full-price machine from the likes of IBM, Compaq or Olivetti.

Versions of the Amstrad offer a choice of colour or monochrome screen. Unlike an official IBM monochrome screen, Amstrad's can display graphics and will represent different colours as shades of grey — a feature often missing in budget machines.

The display is of adequate quality and Amstrad has done a number of things to make it nicer than the normal colour graphics displays found on other PC compatibles. It has an elegant character set and scrolls quickly and without flickering.

The display emulates an IBM Colour

Graphics Adaptor, the most common display system used in PC-compatibles, providing an acceptable text display and reasonable high-resolution graphics.

Amstrad has also added its own special mode — 640x200 high-resolution graphics with a full 16 colours (the standard IBM system can only show two colours at this resolution or four colours with half the detail). No independent software can yet use this mode but new releases for the Amstrad undoubtedly will, as it produces excellent graphics. It can be seen in action when the PC1512 is using the GEM and Basic 2 software supplied with it.

It is definitely a good idea to go to a shop and have a good look at the quality of the display before buying the Amstrad. People who buy the machine and then decide they do not like the display will find it difficult to use the PC1512 with some of the alternative display systems available for other PC-compatibles.

There are several reasons why other types of display cannot be used. The first problem is that the Amstrad monitor must always be connected because it contains the power supply for the whole

machine. A separate transformer could theoretically be fitted, but none is yet available.

Secondly, the display electronics built into the PC1512 cannot be switched off and will conflict with some of the plug-in cards available.

In particular, the Amstrad cannot be used with an IBM Enhanced Graphics Adaptor (EGA) or compatible cards. These provide the sort of detailed displays needed for computer-aided-design and similar applications. Although it is not yet common, the EGA is rapidly becoming popular with owners of IBMs and other compatibles as it also provides high-quality displays when used with many top-selling programs.

One thing that might put some users off is that the colour graphics system produces a rather poor text display. With prolonged use this can be very tiring. A high-quality text card, such as the IBM monochrome adaptor, can be fitted to the Amstrad but this means buying a second monitor and using the PC1512 with two screens attached. This is hardly practical.

It is therefore more-or-less essential to try an Amstrad before buying and check



that the screen quality is good enough. In particular, look at the quality of the text display. This is a long way below the standard produced by the IBM monochrome adaptor and EGA.

Versions of the Amstrad can be bought with one floppy disk drive, two floppy disk drives or one floppy and one hard disk. All come with 512k of memory and this is expandable to 640k by adding memory chips to the main circuit board. Although knowledgeable owners could fit their own upgrades, such as a hard disk or extra RAM, Amstrad insists this is done by a dealer; otherwise the warranty is invalid.

An exception to the rule is fitting one of the many plug-in hard disk cards now available. Nobody is likely to want to do this, though, as it would be cheaper to buy a hard disk version of the PC1512.

The Amstrad has three expansion slots for IBM-type plug-in cards. This is not as many as most other machines but then it is sufficient because there is so much already built into the machine. As mentioned, some plug-in display cards won't work. Neither will some memory, interface and multi-function boards because they have interfaces on them which also conflict with the Amstrad's built-in electronics.

There may be other cards that are adversely affected by the PC1512's fast clock speed and built-in electronics. People who know they will need a particular plug-in card should check out the details before buying an Amstrad.

The keyboard is based on the original IBM PC keyboard. Yet this has a number of small changes from the norm; there are LED lamps on the Caps Lock and Num Lock keys, a small, rather awkwardly positioned Alt key and two extra keys — Delete Forward and a second Enter key placed on the numeric pad.

The two new keys arrive set up to work with many packages — Delete Forward generates a special character (Control-G) which will work in WordStar and many similar programs. The second Enter key is handy in any application which involves numbers. However, the function of both keys can be altered to

suit whichever software is used.

Overall, the layout of the keyboard is a definite improvement over the IBM keyboard, but the same cannot be said for the feel. The keys feel rather cheap and are light to the touch.

The PC1512 is unusual in that it arrives with its own mouse. Although pioneered by Apple on its Macintosh system, the mouse is fast gaining popularity on ordinary PCs — the PC1512 comes with Digital Research's GEM software which uses a mouse to simplify using the computer.

Amstrad's mouse is compatible with the Microsoft mouse, the commonly-accepted standard for mice on PC-compatibles. Almost all mouse software will work with it — both Microsoft Multiplan and Word both worked faultlessly with the Amstrad mouse.

Sadly, however, it is not the nicest mouse unit around and people who find it uncomfortable can't fit a different make.

The heart of the machine is an 8086 microprocessor, operating at an 8MHz clock speed. The standard IBM PC, in contrast, uses the less powerful 8088 chip at a slower 4.77MHz. This makes the PC1512 just over twice as fast as a standard IBM and slightly faster than the popular Olivetti M24. Like most PC-compatibles, an 8087 maths chip can be added to further speed up arithmetic calculations.

In addition, the PC1512's floppy disk drives match its fast processor performance. With many applications, it is the speed of the disk drives which is most important and this is an area where some cheap machines fall down.

The PC1512 is still a long way from the performance of an IBM PC/AT or compatible machine and users who need really high performance may find themselves better off with an AT-compatible, rather than the Amstrad.

The PC1512 has an excellent turn of speed, making the machine more responsive and suitable for all but the most heavyweight of tasks, such as processing large spreadsheets or huge databases.

One potential drawback of the fast

clock speed is that some old software packages carry out their timing in software rather than using the hardware timers built-into every PC. Particular offenders are communications packages and programs which are crudely protected from illegal copying.

It is for this reason that many clones can be switched down to the standard 4.77MHz clock if necessary; a feature which isn't available on the PC1512. However, high-speed machines have been around for a long time and it is difficult to even name a current package which might have problems with the PC1512's (or any other machine's) high processing speed.

The PC1512 also has an IBM-standard parallel printer interface and an IBM-standard RS232 interface for attaching printers, modems and so on. Uniquely, the keyboard includes a joystick interface that will take a standard Atari joystick. This interface is not compatible with IBM joysticks or programs which use them, so it remains to be seen whether any software will be written to take advantage of it.

The PC1512 will appeal to home users, so it makes sense for the machine to be used for games as well as business. In the same vein, the PC1512's sound facilities are a good deal louder than any other PC-compatible. Fortunately, there's a volume control.

A final extra touch is a battery-powered clock, so the PC1512 always knows what time it is without having to be told each time it is switched on. The PC1512 even displays the time it was last used when it is switched on. Such luxury features are nice to have on a budget machine.

System software

No machine would be complete without an operating system of some sort. Strangely, the PC1512 comes with two operating systems, plus the friendly GEM software (which make the micro work a little like the Apple Mac), GEM Paint (a drawing package) and the Locomotive Basic 2 programming language.

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The first operating system is the latest release (3.2) of the obligatory MS-DOS.

Amstrad's version includes a full complement of Microsoft utilities and a couple of its own. NVR is a program which sets-up the PC1512 to suit a particular user every time it is switched on. With it the user can adjust screen colours, mouse speed, set the time and date and so on. Also included is RPED, a simple text editor.

The second operating system is DOS Plus from Digital Research. This works much like MS-DOS and runs most (but not all) software designed for MS-DOS. It also has some small extra features, such as the ability to run up to four simple tasks at once.

It is, however, difficult to see why Amstrad has included it. Having two operating systems is more confusing than one. There is little software to take advantage of DOS Plus's special features and it cannot run all IBM PC software.

It is therefore even more curious that Amstrad has chosen to supply GEM to work with DOS Plus. GEM makes it easier to do common tasks such as copying files, seeing what's on disks, setting up printers and so on. It works using similar icons (pictures), menus and windows to the Apple Macintosh with, of course, the mouse being used to control it.

However, there is only a handful of programs that work with GEM in its easy-to-use style. Most programs can be started from GEM, but GEM then vanishes, leaving an ordinary keyboard-controlled program. When finished, GEM re-emerges.

GEM's usefulness is further weakened because it takes up a vast amount of the PC1512's memory, preventing it from being easily used with many best-selling packages.

So although GEM may look pretty in the shop and may be easy to learn at first, it is sensible to treat the PC1512 as an ordinary IBM-compatible and take the trouble to learn MS-DOS, just like everyone else.

Perhaps the only reason for running GEM is when writing Basic programs. Locomotive's Basic 2 is an excellent version of the popular and easy-to-learn Basic programming language and can produce some spectacular effects using GEM's graphics, colour and window facilities.

However, it only works with GEM and can't be used as an ordinary MS-DOS programming language. So even those who do want to write their own programs may need to buy an ordinary MS-DOS language anyway, such as Microsoft Quickbasic or Borland Turbo-Pascal.

Compatibility

Amstrad claims the machine is '99 per cent compatible.' The PC1512 ran every top-selling serious package we tried on it — including Lotus 1-2-3, dBase III, Multiplan, WordStar, Multimate, Word and Sidekick — and all with a commendable turn of speed. This makes it a sensible choice for almost all potential computer owners as there is a vast and ever-growing range of top-quality programs available for the IBM to do almost any job that can be thought of.

Remarkably, the Amstrad won't run the original version of Microsoft's Flight Simulator. This has long been regarded, as a good test of IBM-compatibility. The latest version of the Flight Simulator, pictured in the PC1512's brochures, does, however, run perfectly.

These problems didn't prevent any major program working and should not be taken as an indication that the PC1512 is significantly less compatible than other budget-priced machine.

Documentation

The PC1512 arrives with a single manual. Amstrad has packed a lot into the manual, but this makes it difficult to understand in places.

The commendable attempt to be non-technical also means it lacks some proper explanations and makes some rather obvious points, such as: 'If you have a printer, you may well want to connect it to your Amstrad PC'.

The manual does cover most topics such as setting-up, MS-DOS, DOS Plus, GEM and a summary of Basic 2 as well as an excellent index. For people who find it hard-going, there are numerous excellent books for the IBM PC and MS-DOS that are also relevant to the Amstrad.

Prices

No definite price can be given for the Amstrad PC1512 as dealers are expected to discount it heavily. The

following prices should be taken only as a guide.

The Amstrad PC1512 with a single 360k drive and monochrome monitor will sell for approximately \$1789. The same system with a colour monitor is expected to sell for around \$2255.

A 512k dual drive with monochrome monitor will sell for around \$2299; while the same system with colour monitor is expected to sell for \$2769.

No pricing has yet been given for the 10 and 20Mbytes hard disks.

Conclusion

Most of the reservations about this machine are minor. The case is a bit delicate, it is not very expandable (but doesn't really need to be), there are some software hiccups and the manual could prove confusing.

Seen in the light of its excellent value, high specification and performance, and its ability to run popular PC packages, they are not really worth considering. The PC1512 is an incredibly powerful machine for the price and, once the owner has got to know it, a pleasant one to use.

One nasty shock for some buyers will be the price of famous-name programs for it. Many programs cost about as much as the micro itself. Happily, comparable products will soon be available at prices more in keeping with the price of the machine itself.

Benchmarks

BM1	0.2
BM2	0.8
BM3	2.0
BM4	2.0
BM5	2.2
BM6	4.2
BM7	7.6
BM8	6.2
Average	3.1

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	8086 running at 8MHz
RAM:	512k expandable to 640k on-board
ROM:	32k
Keyboard:	Detachable 83-key, full-stroke keyboard.
Display:	Optional colour or monochrome (16 colour, grey-scale)
Weight:	6kg
I/O:	Three expansion slots: mouse port; 25-way RS232 comms port; Centronics printer port
Mass storage:	One 360k 5.25in floppy disk drive. Additional hard and floppy disk model available
DOS:	MS-DOS 3.2; DOS Plus; GEM windowing environment

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Cleveland PC II

The Computer Corporation of Australia manufacture a range of PCs; the latest addition to its range is the Cleveland PC II. This machine has a number of features that set it aside from the other PCs.

The main unit, monitor and keyboard are a combination of grey and cream. The main unit measures 49cm x 41cm x 15cm and the keyboard is 46cm x 21cm x 4cm. The review machine came with 640k RAM, a Leo Jet-16 monochrome graphics card, multi-function card, twin 360k Teac floppy disk drives, a PC style keyboard, a Taxan KX-12 amber monitor and an 80186 processor.

Hardware

The front of the unit is similar to an AT, but is smaller. Although there are two full height disk cabinets on this machine, only the one on the right hand side of the unit is visible from the outside. This cabinet contains the two 360k Teac floppy disk drives. On the far left of the front panel is the Computer Corporation of Australia logo, and to the left is a strip containing the PCs name, a power light, an LED for a hard disk and a reset button.

On the back panel, the power socket is on the far left (only one, so monitors must take power from the mains). Above the power socket is the fan cover, and to the left are two D connector slots (for the overflow from multi-function cards). Under the D connectors is the DIN socket for the keyboard, and then to the left of the connectors are the eight expansion slots; two of these are AT style expansion slots.

Taking the cover off the PC II is made easy by the use of two large plastic screws. The cover is loosened using a large flat bladed screwdriver. The screws are actually surrounded by four plastic blades, and when tightened, they force the blades out against the socket and the cover is secured. The whole cover simply lifts off once the screws have been loosened, and was quickly and easily done.

The inside of the PC II is the roomiest machine yet encountered by these fingers. There is a large gap between the back of the drives and the power supply, making it easy to change drive leads, or indeed, drives. The review machine had

four leads for power to drives, or tape units. Two of these were in use by the floppy disks, leaving only two spare. However, there is generally only enough room in PCs to fit up to two more internal devices, so this is no disadvantage.

The second disk cabinet can be used for either one full height hard disk, two half height hard disks, or one streaming tape unit plus a half height hard disk.

All of the RAM chips on the system board are socketed, and so are the support chips. All four banks of RAM chips were populated, giving a total of 640k RAM. There are two ROM sockets on the system board, both of which contain ROMs (for the Bios), and there is room for a coprocessor, although the IC socket

had not been included, which makes it harder to fit the coprocessor.

The main processor is an Intel 80186 running at 8MHz. This chip is a bit of a rare beast; but that in no way implies a slur on this particular Intel chip. It is in fact a fast processor, and capable of running the usual round of PC software at better times than other PCs.

The 80186 is a 16-bit processor and can address up to 1Mbyte of main memory, although the sockets provided only allow for 640k. Presumably, the extra memory could be mounted on an expansion card, and if so, we may see the extra RAM coming from the Computer Corporation. The processor is square, rather than the usual oblong shape, pro-





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bably because of the number of legs on the chip (as on the Motorola 68020) and is covered by a heat shield (so no tinkering with this chip.)

The system board (copyright GAN in the US and made in Taiwan) has one bank of dip switches, with eight settings. The switches control the type of display, the number of floppy disk drives, and the capacity of the drives (360k/720k or 360k/1.2Mbytes). Dip switches 1 to 4 are marked, 'not used' (possibly for future expansion?). There is an additional power light on the system board, supposedly to signify that the system board is alive.

There is only one cover for the eight expansion slots of the PC II, it lies over the top of all the slots and is secured by one screw at the left hand side, which makes it easier to remove, or insert, expansion cards. There was a Leo Jet-16 monochrome graphic/printer expansion board. This was used to drive the Taxan monitor, and a printer, as it also has a parallel port on it.

The Leo Jet is a 16-bit Hercules-compatible high resolution graphics (80 x 25 text and 720 x 348 in graphics mode) card and can be fitted in either a PC, PC/XT or a PC/AT.

The video memory used by this board can be the standard PC video (32k), or using a software switch, can be extended to 64k. The software to control the memory used by the board is supplied with the board, or one can use the Debug utility to do the job. There is a 9 pin D connector on the rear of the board to hook up the monitor, and a standard 25 pin D connector to hook up a parallel printer.

The other expansion card was a multi-function card, with a floppy disk controller, to which two floppy disk drives may be attached, a parallel printer port, two serial ports (configured as COM1 and COM2), a real-time clock and a games adaptor. This board has no dip switches, but many jumpers that can be used (by covering pins with Burgs) to enable or disable any of the board's functions.

The PC II has a standard PC keyboard with all keys in the right places. There are 84 keys, with a separate 10 key

numeric/cursor keypad. The Num Lock and Caps Lock keys have LEDs, and the feel of the keyboard was excellent, probably due in part to the sculpted keys. The keyboard is a solid piece of equipment, and a real workhorse.

The Taxan monitor was of very good quality, with a crisp and clear amber display and high resolution graphics capability. The monitor has controls for horizontal/vertical hold, horizontal/vertical position, vertical line, vertical size, contrast and brightness, as well as a convenient carrying handle.

System software

The Bios is the Computer Corporation's own and is version 1.07. The power up routines are so fast that you can almost start typing as soon as you hit the power switch.

The operating system is MS-DOS 3.10. According to the diskette label, it's Microsoft's and the Computer Corporation of Australia, but when the command interpreter loads, only Microsoft claim the copyright. This version of MS-DOS includes the standard MS-DOS with two exceptions: PC-EM and UN-EM switch the video driver into normal PC mode, and into high speed mode respectively. These two routines are needed, as the PC II defaults to a high speed video driver which will not run all standard PC software.

The PC II also comes with a version of GW Basic with copyright first to Microsoft as version 3.10, and then to the Computer Corporation of Australia as version 1.06. A somewhat bewildering sign on message, but one assumes that CCA has bought its own version of both MS-DOS and GW Basic, and has made alterations and enhancements. On the GW Basic disk are a large number of utilities and documentation files. Some of the routines include: CLVRAMX — a 100k single sided, 360k double sided and a variable sector RAM disk; CLEVE80 — a utility for PC-DOS users to enable it to read/write 80 track drives; and APC 186 which is a driver used to read/write NEC APC III 80 track drives.

Compatibility

This machine not only performed well with all the commercial packages that were tested, but it was also extremely fast. The PC II seemed to cope very well with memory resident programs and PC utilities. This is one machine which I expected to be the least compatible, but I'm pleased that the Computer Corporation of Australia has proved otherwise.

Documentation

The Cleveland PC II is supplied with five manuals. These are all ring bound, and well presented and have been written by CCA, instead of handing out the standard Microsoft manuals, with extra commands tagged on.

The Guide to Operations manual is only 62 pages long, but it does contain information on setting up the PC II, and most features of the hardware and software. However, there is not enough technical information in this manual and it (sadly) lacks an index. This version of the manual was obviously a preview copy, so the final version may include more detail and an index.

The MS-DOS 3.1 Reference Manual did include a good index, but was missing a contents list. While this may not be the heart of the manual it is an essential feature for any user. This was the only fault with the manual. It was otherwise well written, in a style both clear and concise and included good examples, with possible responses. There is a reference section on MS-DOS commands, and separate sections on features of MS-DOS. For learners, CCA include an MS-DOS 3.1 User's Guide. While only containing 80 pages, it does guide the novice through the maze of the operating system functions and commands (it also contains both a contents list and an index).

For Basic fanatics and novices, there is a GW Basic Manual. This manual is primarily designed to be used as a reference book. As such, it is well written, with a complete reference section covering all of the commands, and a section to explain those annoying

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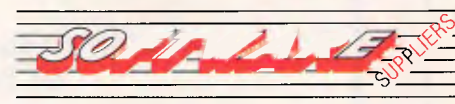
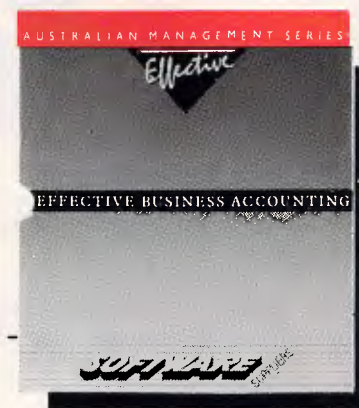
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PC-COMPATIBLES

error messages. Of course there is an index, and a contents list.

Prices

The system supplied for review included; 640k RAM, twin floppy 360k disk drives, multi-function card, a Jet-16 monochrome-graphics/printer card, a Taxan KX-12 monitor, and an 80186 running at 8MHz; it has a recommended retail price of \$3262. Without the monitor, the system would cost \$2907. CCA will supply the system reviewed excluding monitor, but plus a 20Mbytes hard disk, at a recommended retail price of \$4347. It will also supply a system with a 30Mbyte hard disk and an EGA, or Sigma 400 graphics board, and also offer a range of monitors as well as the amber Taxan.

Conclusion

Firstly, the price of PC II configuration is not cheap; but the sheer power offered is alone worth the extra. The PC II, and all of CCA's PC range, have a 12 month warranty, which must also be weighed against the standard 3 month warranty. The documentation does need revising, but contains most of the information needed.

While CCA is a relatively young company, it does have a number of experienced and talented people on board, and are growing quickly.

Like Olivetti, it has moved away from the 8-bit 8088, to a processor that is more in line with the requirements of today's users, and the possibilities offered by current technology.

The PC II seems to fall midway between the standard PC/XT and the PC/AT. After all, who wants a coprocessor, when you can simply have a chip with more power and speed?

Benchmarks

BM1	0.5
BM2	1.9
BM3	3.6
BM4	4.1
BM5	4.4
BM6	7.9
BM7	12.2
BM8	13.0
Average	6.0

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 80186 running at 8MHz
RAM:	640k (the 80186 will address up to 1Mbyte of RAM)
ROM:	16k
Keyboard:	84 key detachable keyboard with LEDs for Num Lock and Caps Lock. PC style layout with sculpted keys
Display:	Monochrome display adaptor driving an amber Taxan KX-12 monitor.
Weight:	Main unit 17kg Keyboard 1.2kg
I/O:	8 expansion slots, speaker, two Parallel port, serial port, real-time clock and a games port
Mass Storage:	Twin 5.25in 360k Teac disk drives
DOS:	MS-DOS 3.10

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Epson PC Plus

Following the successful launch of its PC, Epson has released a PC Plus. While the two machines may look similar, the performance or power per dollar is a good distance apart.

The Epson PC Plus like the Epson PC is a very compact unit. The main unit measures 36cm x 37cm x 14cm. The colour scheme could not be classed as the most fascinating but at least the overall dark grey will not vibrate throughout the office. The PC Plus is available with twin floppies (360k or 1.2Mbytes), and with one floppy and a 20Mbytes hard disk. This combination should satisfy most needs, though another option with a larger hard disk would not be a bad move. The machine supplied for review had a single floppy disk drive (360k), a 20Mbytes hard disk and a Taxan III colour monitor. Epson has dubbed this machine the Epson PC Plus HD.

Hardware

The front of the unit is quite well laid out with two slots for floppy or hard disks. Underneath the drive slots is a compartment which opens and reveals the system dip switches, the reset button and a volume control. Yes, you read correctly, the system dip switches are set in a convenient opening panel at the front of the machine. With this PC Plus you won't need to dig about in the machine searching for the correct switch and getting very frustrated. Epson must take full marks for this little innovation. Not only has Epson put the dip switches in an accessible position, but also had the foresight to place a chart of the switch functions inside the compartment.

There are two banks of switches which allow you to select monitor type, number and type of floppy disks, interface switch settings, coprocessor and parity checking (which allows the machine to check data integrity, but uses processor time and results in a slow machine).

The reset button is well placed, and is out of the way of swinging arms and hovering cups of coffee. Unlike some reset switches this one actually performs a cold start and will get the machine out of the worst tangles.

The very plush front panel is

completed with two small compartments on the right of the machine. The uppermost compartment opens to reveal the power switch, with the usual LED, which is visible when the compartment is open or closed. The power switch, or as Epson has labelled it, the 'system on/off' switch, is in fact a relay switch. This means that the PC closes down before the power is disconnected. If a hard disk is installed, pressing the power switch results in a system message informing you that the hard disk is being secured (parked). The other flip-top compartment houses the DIN socket for connection of the keyboard. Incidentally, the keyboard lead has a very swish connector, the top flips up to allow easy insertion and removal.

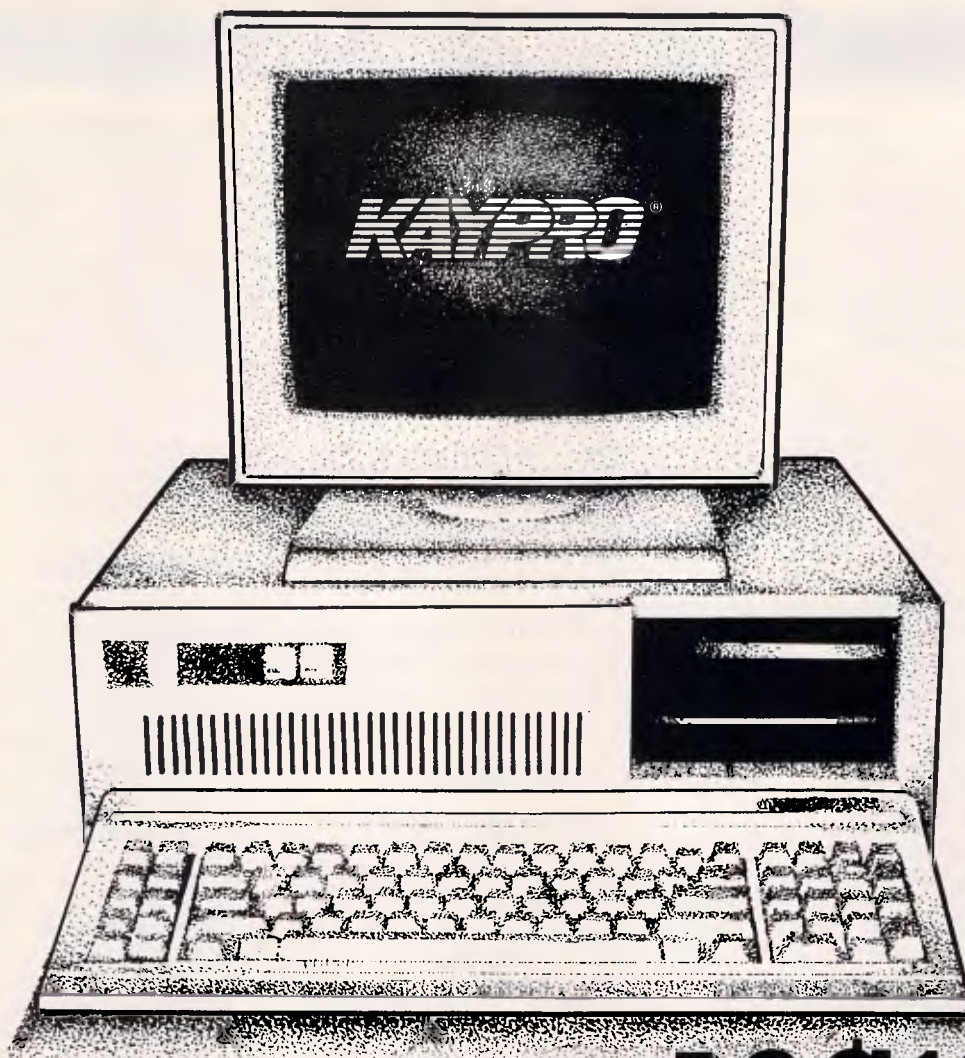
The back of the machine reveals five expansion slots (of the long variety) and several ports that are a standard feature. The ports are all conveniently labelled in clear type, making selections or alterations a great deal easier than the usual 'stop and work it out' approach with most PCs.

Looking at the back of the machine from left to right there are: composite colour video phono socket, monochrome/colour monitor socket, RS232C serial port and a standard parallel printer port. To the right of the ports are the five expansion slots and directly above the ports are the AC outlet and the AC power inlet. The fan is situated next to the AC inlet; in fact the power supply and the fan are housed together and could not occupy less space.

Taking the lid off of the Epson PC Plus is not the easiest of tasks, but is not as difficult as PCs with the many screws and the immovable lids. Rather than go for the car bonnet lid approach many of today's PCs are fitted with, Epson has fitted a lid with three screws at the rear of the machine and two on each side. All of the screws come out very easily and the lid rolls off like a dream.

Having removed the cover from the unit, there was not very much to see. Most of the system board is positioned underneath the disk cabinets. As mentioned earlier, all of the five





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expansion slots (all long), will accept standard PC expansion boards. The floppy disks plug into the system board leaving more room for expansion boards. Removing the disk cabinets and the power supply exposes all of the system board. The biggest surprise is the chip count, which is fairly high, giving the impression of a very busy board.

In keeping with all the other features of the Epson PC Plus, the system board is tidy and it's easy to find your way around. The processor is an NEC V30 running at 4.77MHz switchable to 7.16MHz. This processor is totally compatible with the Intel 8088. In fact the instructions are a super set of the 8088. There is an IC for a 8087 coprocessor. A number of the chips on the board are customised and there are three Eprom's (presumably these will be replaced with ROMs eventually. The firmware was undoubtedly developed for, or by Epson, but supports PC applications. There are no spare ROM sockets on the board. There was the familiar rechargeable battery pack.

To switch clock rates permanently you need to change jumpers on the board; so this is not the kind of thing you will do by accident, and is a little inconvenient. Epson has set the jumpers for a clock speed of 4.77MHz and say that memory expansion cards need this setting to operate. However the clock rate is also software controllable, which is much simpler. The standard memory on this PC is 640k, probably sufficient for most PC applications. So you set the jumpers at 'full ahead', unless you intend to add a few megabytes of memory.

As you would expect with a machine this small, there is no extra room inside for a second hard disk or a streaming tape drive. Although one presumes that the hard disk could be a 60Mbytes drive, virtually configured as drive 0 and drive 1. Virtually configuring drives is achieved with a special drive controller or with software such as Disk Manager. It is necessary to go to these extremes with any drive over 32Mbytes as MS-DOS only recognises 32Mbytes, (this drawback in MS-DOS is well overdue for correction).

The keyboard layout differs from the standard PC; some of the keys have been

rearranged which is a great disappointment for regular PC users. The escape key is at the top left of the numeric pad instead of the top left of the qwerty board and the PrtSc key has been put on the numeric pad. In general, the keyboard is AT style and some of the most used keys have been moved, which takes some getting used to, but the effect is well short of disastrous. The enter key is actually marked 'Enter' which is refreshing, especially when writing documentation. The enter key is large separating it from surrounding keys and removes the risk of hitting the wrong key. The general feel of the keyboard is excellent, and would please the most experienced typist and the most cynical of programmers.

The Epson PC Plus keyboard is well made and is comfortable to use, with adjustable feet and very responsive keys.

System software

When the system is first powered up there is no sign on message, just a message stating the amount of RAM available. But reloading the command interpreter reveals that the version of MS-DOS is 3.1 and is Microsoft's and Seiko Epson Corporation. No real surprise that Epson has bought its own version of MS-DOS from Microsoft and that most of the software tested worked well. However Epson supplied a patch for running Lotus, so there are some differences in this implementation of MS-DOS.

All of the expected commands were present in this version of MS-DOS, with several additions and differences. The Format routine is specifically for floppies and Epson has supplied another utility to format hard disks, but the standard 3.1 Format routine formatted the hard disk without any problem. Epson supply two system disks, however, for this review only one disk was supplied, which meant that the hard disk utility and other programs were not available for evaluation. Also notably missing was a version of Basic, but a standard version of GW Basic worked very well, as did various Basic compilers.

Apart from the hard disk utility other new commands include: SETCMOS which allows the user to set/editor parameters kept in CMOS RAM; POWER which allows the user to switch the PC off (via software and using the SETCMOS command), have it wake up at a certain time or using a modem to power it up via a modem signal; ROM BIOS will return the name and number of the ROM BIOS you are using; SPEED which will switch the current clock rate; and SETUP which is a menu driven utility allowing the user to set peripheral and port parameters and protocol.

Compatibility

As mentioned earlier, the Epson PC Plus was supplied with a patch for Lotus which seemed to work without any problems. Other PC products functioned well on this machine, however, the utilities tried did not and in some cases the tests were aborted.

Documentation

The Epson PC Plus comes with three manuals all written by Epson and reasonably presented. The first, called Setting Up and Getting Started, is a 71 page manual which explains how to set up the PC and goes into some depth. There is a comprehensive trouble shooting section and a good index. In practice this will be a useful manual while you become familiar with the machine.

The second manual, Everyday with

Benchmarks

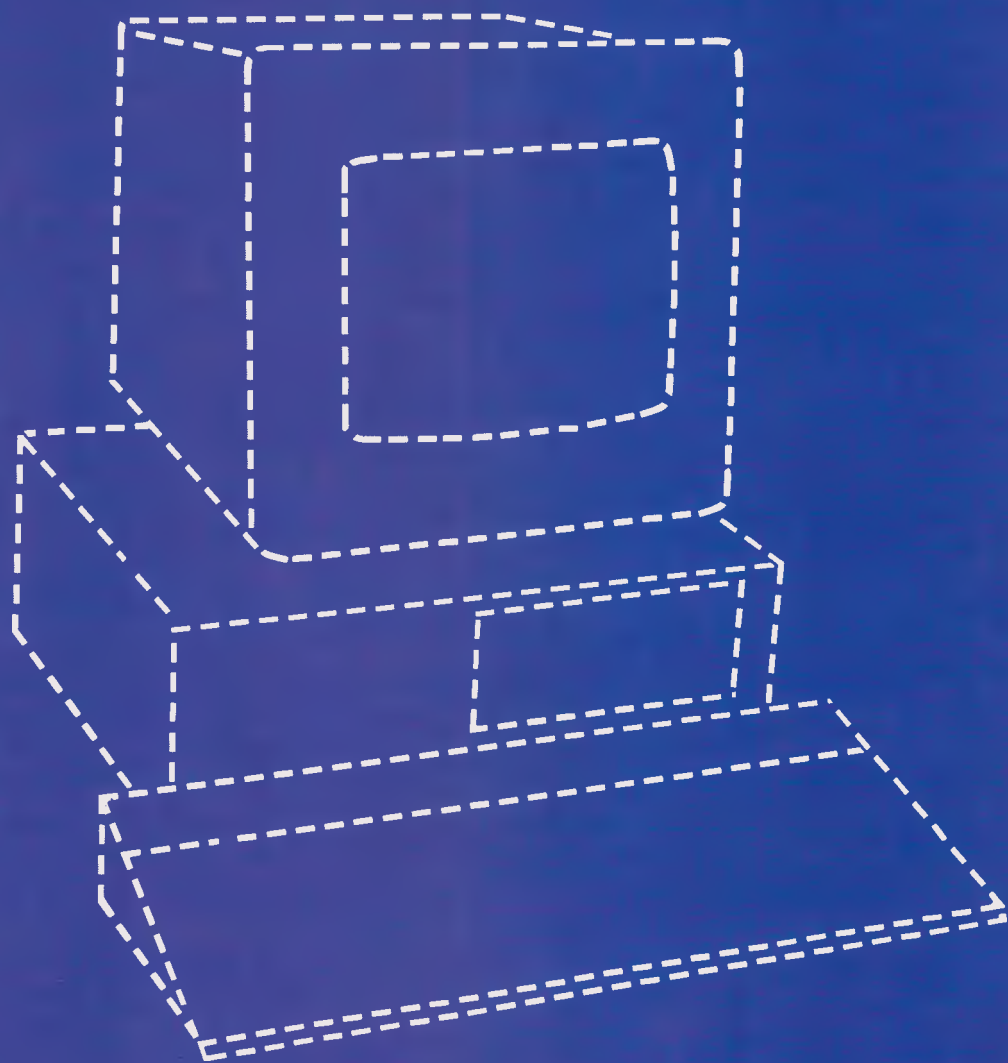
BM1	0.5
BM2	2.0
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BM8	14.5
Average	6.5

All timings in seconds.

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MS-DOS, is well presented, but short at only 90 pages. This manual is intended as a quick guide to the novice MS-DOS user and as such you could say it works. Epson would have done better to scrap both of these manuals and provide every user with a technical reference manual (something all PC manufacturers should be doing).

The third manual, MS-DOS 3.10 Reference Manual is by far the best of the three. It is well written with clear explanations of commands as well as good examples of their usage. This is one of the better MS-DOS manuals, but again Epson could have given more technical information on MS-DOS, particularly as its version differs from the Microsoft version.

Prices

The Epson PC Plus is available in two main configurations. The base level machine includes the main unit, keyboard, 640k RAM, parallel and serial ports, five expansion slots, real-time clock, two video ports plus two floppy disk drives. It has a recommended retail price of \$4788 or \$5940 with a Taxan III Super Vision colour monitor. The second configuration is the base level machine with a 20Mbytes hard disk, one floppy disk drive, and a Winchester disk controller board. This has a recommended retail price of \$6420 or \$7512 with a Taxan III Super Vision colour monitor.

Conclusion

The Epson PC is certainly good value for money and of course coming from the printer giants, it will attract a good deal of attention. This is in part due to user expectation of good quality, good service and flexible support. This can be misleading, as some large manufacturers actually send repairs to contractors. I recently had the misfortune to destroy a good deal of the main board on my Epson FX-80 by putting 12 volts through the parallel interface. Epson informed me that another company took on all of its repairs. This unnamed company was far short of reputable and after much trouble

and expense the maimed printer came back nearly fixed. In any event, one could not recommend Epson's method of undertaking repairs.

Back to the Epson PC Plus, it is a very compact, fast machine with a slick appearance, and of course, will not be short of peripherals (especially printers) to attach to it. It goes only part of the way to filling market demands for machines that are smaller and more powerful. The other reservation is the compatibility. Some utilities did not function, and as mentioned earlier, Lotus requires a patch to work. However, that is not a huge drawback, and most PC applications will run without any problems.

Technical specifications

Processor:	NEC V30 running at 4.77MHz, hardware and software switchable to 7.16MHz
RAM:	640k
ROM:	16k
Keyboard:	Detachable 83 keys including 10 key numeric/cursor pad
Display:	Optional monochrome or colour monitor (will accommodate most PC monitors)
Weight:	Keyboard 1.4kg Main unit 10.5kg (dual floppy) 10.9kg (hard disk and one floppy)
I/O:	Composite colour/mono video output, colour/mono monitor output, parallel printer, serial port, real-time clock, speaker, five full length expansion slots and power sockets.
Mass storage:	Either 20Mbytes hard disk and one 360k/1.2Mbytes 5.25in floppy, or two 360k/1.2Mbytes floppies.
DOS:	MS-DOS 3.10

Leading Edge PC

The Leading Edge PC is another compact unit. The size is about the same as the Epson PC Plus and it looks very similar to the Epson — let's see how it compares. The Leading Edge comes from the US, but according to the labels at the back of the machine, is manufactured in Korea. One should note that the major difference between the Leading Edge PC and the Epson PC Plus is that the Leading Edge is not a PC Plus and has only a standard Intel 8088 processor running at 4.77MHz.

The machine, supplied by SNS Leading Edge, the Australian distributor, had a 30Mbytes hard disk, one 360k floppy and a colour monitor. The colour scheme of this machine is a few shades

darker (grey) than the Epson PC Plus, but the hard disk panel was black. The main unit measures 35cm x 39cm x 14cm, which is roughly the same size as the Epson PC Plus.

Hardware

The front panel from right to left include the power on/off switch, a small lever which locks the floppy drive door and directly underneath the power switch is the reset button. Moving left, are the disk cabinets, one floppy and one hard disk. Of course both drives have power lights. To the left and below, is the DIN socket for the keyboard connector.

At the back of the machine from left to

right are four sockets: a mono socket, a colour socket, serial port and a parallel port. All of the sockets are well labelled and easy to reach. Directly above the sockets is the power supply with an AC inlet and an AC outlet. To the right of the power sockets are four long expansion slots. One is taken up with a hard disk controller, which had an Adaptec board.

Taking the cover off the Leading Edge was very simple. It is held on by two screws each side and three screws at the rear. Again most of the system board was obscured by the power supply and the disk cabinets. So once again, tight lipped and with screw driver firmly gripped I proceeded to remove the

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In terms of speed, quality and design, it can hardly **”**be faulted.

FRANK WOOLF, REVIEW OF M28, BUSINESS
COMPUTING & COMMUNICATIONS, SEPTEMBER 1986.

The first part of the judging was probably the easiest – selecting the most popular machine. Here the Olivetti M24SP won easily, securing three votes out of five because of its high construction quality and superior performance...

GARY ROSS, SHOWDOWN FOR THE PC CROWN,
TODAY'S COMPUTERS, MAY 16, 1986.

olivetti

PC-COMPATIBLES



power supply and the disk cabinets. While this was not difficult, there were many screws to take out.

When at last the system board was unveiled, I discovered that most of the chips are soldered in, rather than plugged into IC's. This makes the board cheaper to manufacture, but is very inconvenient for users, who have to take the machine to a dealer or another capable person to have damaged chips replaced or chips upgraded. In fact the only chips not soldered were one bank of RAM chips, one ROM and the processor (there were two empty IC sockets: one for an 8087 coprocessor and one spare ROM socket). The processor is an Intel 8088, running at 4.77MHz. There is also a back up battery pack.

While soldering the chips on the board is not very attractive, it is done by many manufacturers and the overall appearance of this system board was crowded, but tidy and without any loose or bare wires.

Like the Epson machine the chip count on the board is high, because of all the

inbuilt ports (colour/mono switchable, parallel and serial). It is a luxury for any PC to have this many ports as standard. Hopefully this will become standard on future machines and we will no longer have to pay exorbitant sums for these ports, and then have to struggle with boards, screwdrivers and wires to fit them.

The dip switches on the machine consist of one external switch at the rear of the unit, to select either mono or colour; and an internal bank of eight switches which select the number and type of drives, RAM tests at power up, enable/disable external monitor select, and selection of the coprocessor.

The keyboard is more or less the standard PC qwerty keyboard, with all of the well used keys in familiar positions, and adjustable feet. In use, the keyboard is surprisingly smooth and makes a distinct click as you type.

System software

The power up routines seem to take

forever on the Leading Edge. A look at the ROM signature reveals that the firmware is written by Phoenix Software, and is version 2.13 for the 8088. In fact the power routine and tests were so slow that I could type all this while it was powering up.

The version of MS-DOS is standard Microsoft 3.10 with a few utilities added, such as:

CHMOD which is a Unix style utility that allows the user to view or set file attributes; COLOUR which selects the colour monitor as the active display; MONO which selects the monochrome monitor as the active display; RELEASE which informs the user of the model and release number; XASSIGN which redirects all requests for one drive to a different drive or allows redirection for specific files; and XTREE which displays all subdirectories of the current directory.

Applications software

The Leading Edge PC is bundled with a word processing package called, Leading Edge Word Processor (LEWP). Its design is similar to Multimate, which is probably a good way to go, as Multimate is a very powerful and flexible package. The word processor has an Install procedure and an extensive tutorial program, a quick reference guide, a keyboard overlay and a large well written manual. The main features of the package include: menu driven programs, a multi-level filing system, automatic filing of new text, and the usual word wrap and ruler. When editing a document the user can use specific keys to move through the document quickly, mark text for deletion, copying or moving. LEWP has an overtype and insert mode that are easily selectable, and printer attributes can be put into the document as you write it. This feature was probably best used on PCWrite, which is public domain software and is the word processor used to write these articles.

Some of the more unusual features are the ability to recall deleted text, a constant check on available disk space, the ability to edit multiple files and assign each file to a different window. This

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facility also allows the user to employ all of LEWP's commands across files, which is a very powerful and extremely useful facility. LEWP is also written with memory resident utilities such as Sidekick in mind (so those of you who are hooked on Sidekick will not have to do without it if you are using LEWP). LEWP also has a Macro facility so that the user can create a sequence of commands and save them in a file to be called whenever needed, this can save a lot of tedious typing for often used commands. Finally LEWP has a powerful spelling checker and a utility to convert dBase files to LEWP files.

LEWP is certainly a fine word processor and the above is just a brief overview of its total capabilities. It is free if you happen to be purchasing the Leading Edge PC, but is also available on its own if you wish to purchase it.

Compatibility

There were a few problems with the hard disk on this PC, but it is not clear if it was an internal fault or due to the number of PCs I had running at the time. However, apart from a few interruptions, the Leading Edge PC passed the critical tests of dBase, and Lotus. There was one particular utility (a keyboard buffer extension) that caused slight problems, which indicates some small difference.

Documentation

The machine comes with five manuals. There is a small manual titled, Operators Guide for the Model D which is the manual for the review configuration. There are also three other configurations available: single floppy unit, twin floppy unit, and single floppy plus 30Mbytes hard disk and an 80286 express board. Obviously, these will have different operator manuals. The Operator's Guide in general, takes the

user through the process of setting up the machine, using MS-DOS, an extensive troubleshooting guide, and information on the internal switch settings and upgrading the machine. The manual is completed with a comprehensive index.

The second manual is an MS-DOS Reference Manual for version 3.10, which is a fairly standard manual, and is well written with all features of MS-DOS well documented with clear examples.

The third manual is a guide to Basic (in fact it is GW Basic version 3.11 (c Microsoft and Phoenix). Again this is a well written reference manual covering most aspects of a language that is already well over documented.

The fourth manual is a Users Guide to MS-DOS, which is a short introduction for the novice to MS-DOS. The last manual is the user guide for LEWP and again this is well put together and well written taking the user through every aspect of the word processor. Leading Edge has written excellent manuals and documentation to accompany its machine.

Prices

As mentioned earlier the Leading Edge PC is available in four configurations. The base level machine consists of: the main unit with 640k RAM, serial port, parallel port, internal mono and colour ports, standard qwerty keyboard and monochrome monitor. The recommended retail price is \$2845 or \$3545 with a colour monitor. For a unit with twin floppies the recommended retail price is \$3395 or \$4095 with a colour monitor. The next configuration is a base level machine with a 30Mbytes hard disk which retails at \$5095 or \$5795. The Express machine includes a base level unit with a 30Mbytes hard disk plus a 80286 express board which retails at

\$6295 or \$6995 with a colour monitor.

Conclusion

As a standard PC the Leading Edge comes out above average. The three main advantages of this machine are the onboard ports, saving valuable expansion slots for other boards; its compact size means that it will fit on one corner of your desk instead of dominating the whole of it and the bundled word processor.

The disadvantages are the slow clock rate (the Intel 8088 is by now old technology even in PCs), a noisy keyboard (although very responsive), and finally the firmware seems to be rather slow.

This machine is not a good purchase if you are looking for the latest in PC technology, but might be a good starting point for a standard workhorse. Now if you put an 8086 in this machine as standard well...

Benchmarks


BM1	1.3
BM2	4.8
BM3	9.3
BM4	10.7
BM5	11.6
BM6	20.9
BM7	32.4
BM8	34.1
Average	15.6

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 8088 running at 4.77MHz
RAM:	640k
ROM:	16k
Keyboard:	Detachable 83 including 10 key numeric/cursor keypad
Display:	Colour or monochrome display output as standard, with separate output ports, switchable via a small switch at rear of main box. The display ports can be disabled via an internal dip switch, so that EGA style boards can be used instead
Weight:	Main unit 12kg Keyboard 2.5kg
I/O:	Colour and mono ports, parallel port, serial port, real time clock, four expansion slots and a speaker
Mass Storage:	Either one or two 360k floppy disks, or a single 360k floppy disk plus one 30Mbytes hard disk
DOS:	MS-DOS version 3.10



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WPS-PC - complete compatibility with the DECmate 'Gold Key' system

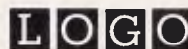
- * Keystroke compatibility with the industry standard WPS wordprocessing system, as used on the DIGITAL DECmate. Built-in communications facilities provide for document exchange with DECmate systems.
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1. WPS-PC is amazingly easy to learn so you and your staff will be productive sooner. Its famous Gold Key system of commands are both logical and memorable. People quite unfamiliar with computer equipment quickly grasp this approach to

2. Commands can be executed with greater speed and fewer keystrokes with WPS-PC. There are no complex control sequences to learn. Even an occasional user will find it easy to drive. On-screen bolding, underlining and simple "cut and paste" functions make editing fast and simple.

3. WPS-PC is a complete system. An excellent spelling checker, sophisticated list processing, communications and file translation facilities, all integrated in one package. For DECmate users, WPS-PC has two way file transfer with their old system.

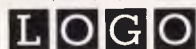
4. WPS-PC puts the user at ease. All menus and help instructions are in plain English. Contrast this with the often incomprehensible and cryptic messages of other wordprocessors.

5. WPS-PC is better designed for storing and editing documents.
* Document names are stored in a properly indexed directory (which may be printed out or viewed while you are editing documents). A full description may be included in this index. Most wordprocessors only allow crude 8 letter names, no index and no facility for description.

* WPS-PC stores all the formatting instructions for each document with the document. Other wordprocessors require the operator to reload formats every time the document is edited.

* WPS-PC can drive a wide range of printers (including the latest Laser types), both draft and letter quality. * Full background printing is provided. Many wordprocessors keep you waiting while your computer is printing. With WPS-PC you're working on the text job.

6. WPS-PC is a fully supported system. Not just with telephone help, but with the highest standards of individualised training in Australia. And it isn't expensive. We can provide just the software, or a complete WPS-PC system. Call now for prices. You'll be pleasantly surprised.



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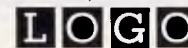
A Print Manager saves a huge amount of time:

1. **No more plugging or unplugging printers.** The Print Manager connects the right computer to the right printer. Up to 4 computers to 2 printers, automatically.
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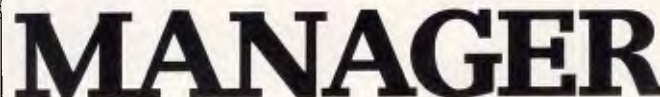
There is a Print Manager to suit your requirements. Print Managers are available in most serial and parallel configurations, allowing almost any 4 computers to share 2 printers.

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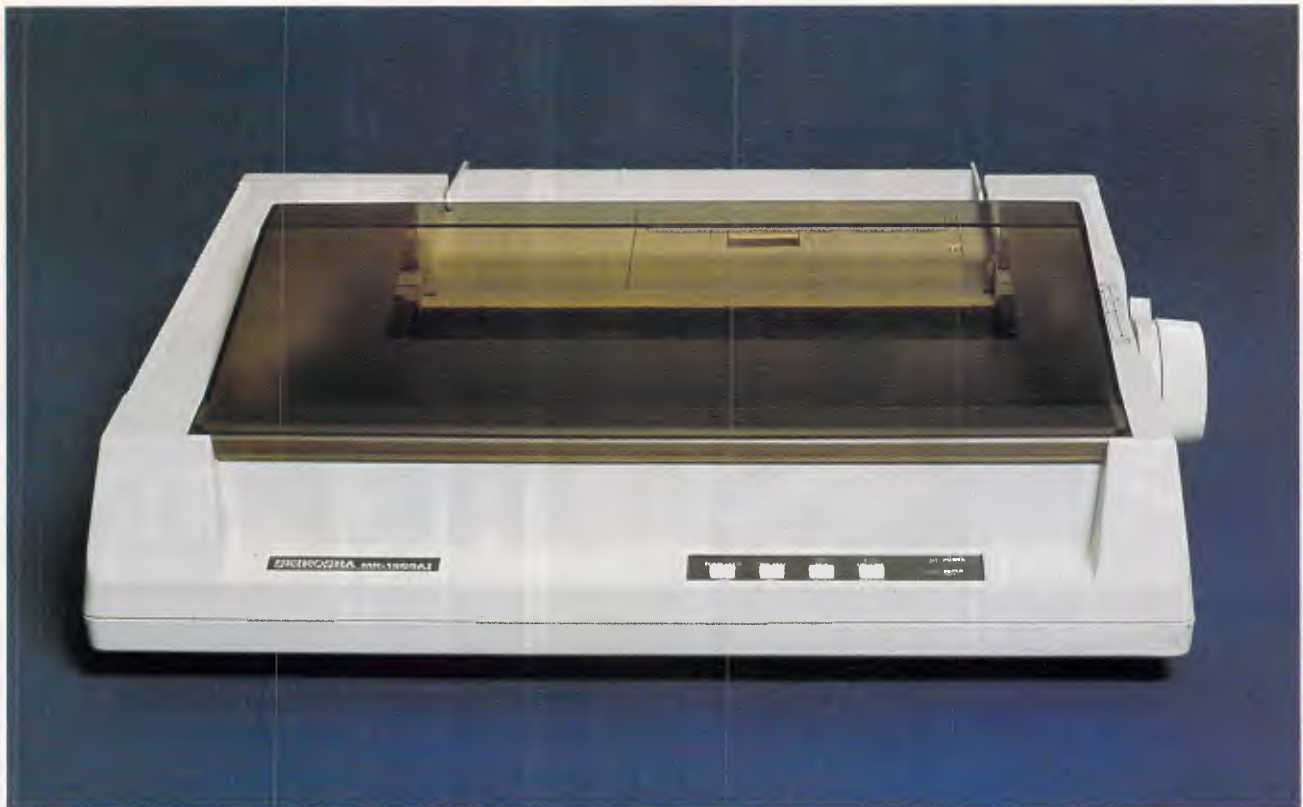


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Basic Time BTurbo PC

This machine takes a lot of desk space. In general appearance it looks very similar to the original IBM PC, and those of us familiar with standard PCs would have no trouble finding our way around this machine.

The machine supplied by Basic Time has a twin 360k floppy disk drive with an amber monitor. The main unit is a combination of dark grey with a cream front panel and the usual black panels for the disk cabinets. The main unit measures 49cm x 41cm x 14cm.

Hardware

Looking at the machine from the front, right to left there are, four disk cabinets (only two were populated with floppies, the remaining two could be used for hard disks or streaming tape and hard disk). Moving left is the reset button (which performs a complete reset), two power lights (one for turbo mode and one for normal mode). Below the power light is the DIN socket for the keyboard connector.

Not a lot to see, but at least the front is tidy and uncrowded. Some users prefer all of the functional parts of PCs to be tucked away out of sight, and some prefer to have everything they need in sight and within easy reach.

Looking at the back of the machine from left to right there are the two power sockets (AC inlet, and AC outlet). Directly above the power sockets is the manufacturer's label which informs us that the machine is a PC-401 Turbo and is made in Taiwan. Next to the power sockets is a small fan cover and to the left of it is a vacant round hole. This is usually the DIN socket on most PCs but Basic Time has moved this to the front of the machine and left a hole in the rear cover. Presumably, this is because the covers are from a standard mould, but one would expect the rear DIN hole to have been removed (perhaps there is a facility to connect a second keyboard, 20 fingers are quicker than ten!).

Finally, moving left there are the standard eight slots; the Basic Time has two short slots and six long ones. Of course, one of the obvious disadvantages is the lack of parallel, serial and video sockets as standard. This means that the user must purchase these ports and lose valuable expansion slots.

Removing the cover was very simple. It is held on by five screws at the rear and the cover slides forward and lifts off. The system board is fairly well built, but there are a few straying wires at the front of the machine. They were the wires for the

speaker and the power lights, and it would have been a fairly simple task to secure them. In contrast, all of the power and drive leads were very well secured and placed out of the way. The power supply is a standard unit which incorporates the fan. As mentioned earlier, the drives are 360k Teac floppies, (very good quality drives).

The processor is an NEC V20, running at 4.77MHz and switchable to 8MHz. NEC V20/30 processors are being used widely in PCs now, and are currently very cheap. The clock rate can be selected



from the keyboard or via software. Basic Time provide two utilities for clock rate: Turbo and Normal, 8MHz and 4.77MHz respectively. The system board has a spare socket for an 8087 maths coprocessor, and four banks of ICs for RAM. The review machine had a total of 640k RAM (all banks were populated). This is the standard RAM for the Basic Time machine. There are two ICs for ROMs. One was empty and the other contained Basic Time's 8k Bios. The system dip switches consist of only one bank of four switches which select the monitor type and the system disk configuration. There is no switch to indicate the presence of a coprocessor, or for RAM. The user manual claims that as the maximum RAM (640k) is installed that no switches are needed for RAM!

Of the eight expansion slots available, four were occupied on the review machine. Three were occupied by cards, and the fourth was taken up with a D connector for a parallel port. The only full size expansion card was the B-15 monochrome graphics card. It allows the user to hook up a monochrome monitor and also has a parallel port on it. The graphics card comes with a short manual, which has some useful technical information on using the board with another video card, and notes for programmers. While Basic Time claim that this board will work with standard monitors, users should be aware that it is not a standard board and there could be some memory conflicts.

The second card was the B-250, which was a three quarter length board (one of those that are not secured at one end and just flap about in high winds). This card contained a games port, and a serial port with connectors on the rear of the card. The card also has a parallel port which is connected to the card via a flat 25 way lead with the standard 25 pin D connector. The connector is mounted on a bracket and fits into another expansion slot (there goes another slot). Lastly, the B-250 has a clock/calendar card and provision on the board for a second serial port (COM2) which of course will occupy another expansion slot.

There is one large set of jumpers and two small sets to enable or disable the ports on the board.

The third and last card was a floppy disk controller. This was a short card and handled both floppies. If one or more hard disks are installed then another disk controller will be needed (unless of course a hard card is used).

In all, the Basic Time 'standard' model comes with the capability to hook up four printers or two printers and two modems plus a joystick and two monitors.

The monitor that Basic Time supplied

was an Amber Qubie, with a tilt swivel (which always wanted to point downwards). The monitor was reasonable to work with, and fairly kind to the eyes.

The Basic Time BTurbo came with a keyboard labelled 'Basic Time', and again was manufactured in Taiwan. It is an AT style layout with a row of LEDs above the numeric keypad, and separate cursor control keys next to the space bar. The general feel of the keyboard is wobbly and cheap. Although it did function well, one wonders how long it would last.

System software

The power up routines were extremely fast and were accompanied by a full screen sign on message. The version of MS-DOS is standard Microsoft 3.10. Also bundled with the BTurbo is a package called ZylIndex. ZylIndex is a file handling utility which will sort and index named text files or files created with any word processor. It is a menu driven utility, with full help screens to guide you through the maze of options and the confusing documentation. The package comes in two versions, one for the novice and one for the professional.

Also bundled with the BTurbo is a

Benchmarks

BM1	0.8
BM2	2.8
BM3	5.2
BM4	6.0
BM5	6.6
BM6	11.8
BM7	18.2
BM8	18.7
Average	8.7

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

floppy disk or hard disk utilities. The main utility is called '1 Dir', and it is a file manager. It gives the user an environment in which executing DOS commands is a matter of selecting the command from a menu. The user can also create custom menus and batch files. If you wish to have your hand held to this extent and be protected from DOS, then '1 Dir' or one of the many similar programs available will aid you.

Compatibility

The Basic Time passed all of the tests put to it in terms of compatibility with commercial packaged software, such as dBase III Plus and Lotus which performed well. However, a few utilities tested did give some problems which is not unusual with memory resident programs.

Documentation

There were six manuals supplied with the Basic Time BTurbo. The first is the Users Manual and includes a setup procedure and sections on the system board, drives, keyboard, monitor, dip switch settings and available options. This manual is split into six sections and has no index, so is not too useful as a reference book.

The second manual is MS-DOS Operating System User's Reference which is the DOS reference manual and all I can say about it is that it barely covers the essentials of DOS. Again there is no index, which makes it almost useless. An index in this book would be essential for daily use. Not that this manual is worthy of such regular use.

There is a large manual on ZylIndex, the file index utility bundled with the BTurbo. This is, to say the least, a confusing manual offering the information required but not in the order one would expect. Its only saving grace is the inclusion of an

Technical specifications

Processor:	Intel 8088-2 running at either 4.77MHz or 8MHz (software or keyboard switchable)
RAM:	640k
ROM:	8k
Keyboard:	Detachable 88 key keyboard (AT style) including 10 key numeric/cursor keypad, separate cursor control keys and LEDs for Caps Lock, Num Lock and Scroll Lock keys.
Display:	B-415 monochrome graphics board with an amber monitor fitted with a tilt swivel
Weight:	N/A
I/O:	8 expansion slots, speaker, two centronics parallel ports, one serial port and one game port
Mass Storage:	Twin Teac 5.25 floppy disk drives with cabinets for two more drives
DOS:	MS-DOS version 3.10



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The same comment applies to a programming environment – ALICE provides over 500 "Help!" screens, with context-sensitive help, ranging from "What can I type here?" to "What program called up this sub-routine?". At the same time ALICE provides immediate assistance with problems, instructing the user about Pascal – so programming gets easier and easier.

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index. As long as you know what you are looking for, (this means having some knowledge of the package) you will probably be able to find it via the index.

The next manual is on the file manager, bundled with the BTurbo. It is a fairly ragged manual with 75 pages of badly written text, and again no index.

The last two manuals are on the monochrome graphics card and the B-250 I/O card. They are the standard short manuals supplied with the board by the manufacturers, and simply cover installation and include some technical information.

It is many years now since the PC industry really hit the business community, and the kind of documentation supplied with the BTurbo should also be many years behind us. Users are no longer content to put up with documen-

tation which leaves them guessing about hardware and software. All manufacturers still indulging in second rate manuals should really catch up with the competition.

Prices

The Basic Time BTurbo base level machine includes two 360k floppy disk drives, 640k RAM, Qubie amber monitor, MS-DOS 3.10, ZylIndex, 1 Dir and sells for a recommended retail price of \$2155. Basic Time will also provide as options a colour Qubie monitor and expansion board and a range of Qubie hard disks with disk controllers.

Conclusion

The best thing about the BTurbo is

probably the price, it is a fairly cheap PC and well within the reach of most users and potential users. The Qubie monitor is also a reasonable workhorse.

The pitfalls of this machine are many. Firstly the documentation is poorly written and the manual layouts seem to be very haphazard. One would expect a machine labelled as 'turbo' to be faster, but even with a clock rate of 8MHz it performs badly.

The keyboard is of the cheap variety and one would not wish to expose it to constant use.

It would not even really be a good machine for a beginner. It presents a poor picture of the micro computer industry.

Atlantis PC/XT

This PC is a departure from most of the machines reviewed here. It is not a turbo PC, but a standard PC/XT, which has an Intel 8088 on board, and runs at 4.77MHz, the standard clock rate. However, Atlantis International Computers, says it has a new version of this machine but was unavailable for review. The machine should be available in December. It will be a turbo machine with an Intel 8088-2, running at 4.77MHz and switchable to 8MHz via hardware or keyboard. The turbo version has a four layer motherboard, and other than the changes outlines, it will be configured exactly the same as the PC/XT. Atlantis will be selling the turbo version for an extra \$150.

In the meantime, we do have the Atlantis PC/XT to look over but before we delve into this machine, it is worth looking at a couple of other features that Atlantis offer. All of its PCs have a 12 month warranty. It is reassuring to see that more companies marketing compatibles are introducing a 12 month warranty, rather than 3 months. The most interesting service that Atlantis has to offer is a fast repair service. Atlantis claim, if anything goes wrong, return the computer to the office and Atlantis guarantee the fault will be repaired within 15 minutes. If not, the system will be replaced with a new one, free of charge. Atlantis is however considering

changing the 15 minute clause to 30 minutes, because of the difficulties involved with hardware not supplied by themselves. Even so, this is a good offer, and should make clients sleep better at night.

Hardware

The Atlantis PC/XT is a standard PC,

with the familiar grey colour for the main unit and the keyboard. The main unit measures, 40cm x 49cm and the keyboard is, 45cm x 19cm x 3.5cm. The front of the machine has Atlantis's label on the far left, and the two full height disk cabinets. The review machine had two 360k Mitsubishi floppy disk drives. The power switch is located on the rear right of the unit, and is the large red switch,



with clearly marked on/off positions.

The rear of the unit sports another large label with the manufacturer's name and the serial number. Below the label are the AC inlet and the AC outlet sockets, and directly to the left of the power sockets is the fan cover. Moving left are two D connector slots, for extra parallel or serial ports (the sort which come off a multi-function board). Below the D connector slots is a standard DIN connector socket for the keyboard. Finally, there are eight expansion slots, three of which were occupied on the review machine.

Opening this PC/XT was easy, as it has the flip-top style cover. One simply presses the buttons; one either side of the unit and the cover pops up and is held in position by a sliding bracket (it really is a pleasure to leave the screwdrivers alone, and just push buttons instead). Looking inside the box one immediately notices a plastic bag which is taped to the side of one of the disk cabinets. Inside the bag are some useful extra brackets for expansion slots, complete with screws and some extra 'Burgs' (jumper covers, named after its inventor). The two Mitsubishi drives occupy one of the disk cabinets. The other is empty, but of course can be used for half or full height hard disks or a streaming tape backup drive and a hard disk.

Benchmarks

BM1	1.3
BM2	4.7
BM3	9.1
BM4	10.5
BM5	11.4
BM6	20.5
BM7	31.7
BM8	33.9
Average	15.4

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 8088 running at 4.77MHz
RAM:	640k
ROM:	8k
Keyboard:	84 key IBM PC/AT style keyboard, detachable, with lights for, caps lock, num lock and power
Display:	Standard colour graphics adaptor
Weight:	Main unit 13kg Keyboard 2kg
I/O:	8 expansion slots, speaker, parallel port, serial port, real-time clock and a games port
Mass Storage:	Twin 5.25in 360k Mitsubishi disk drives
DOS:	MS-DOS 3.10

The power supply and the fan are housed together at the rear of the unit. The system board has the usual support chips and an Intel 8088, running at 4.77MHz, there is a spare socket for an 8087 coprocessor and six ROM sockets. Only one of these is occupied by the Bios, but it is always useful to have spare ROM sockets on the board. There are two banks of dip switches. The main bank controls the system tests when the machine is switched on, plus installed peripherals. The second bank controls the amount of RAM actually installed. There are four banks of RAM chips, giving 640k RAM. All of the main chips, including all of the RAM chips, are plugged into IC sockets and can be easily removed or replaced.

Of the eight expansion slots, seven will take short or long expansion cards, and one will only take a short expansion card. On the review machine there was a standard colour graphics card which will drive both colour and monochrome monitors. The colour graphics card also has phono and D connectors, for connection to a monitor. There was also a multi-function card with a battery-backed real time clock, parallel port, two serial ports (configured as COM1 and COM2) and a games adaptor. The last card was a floppy disk controller, manufactured by Falcon Technology Incorporated.

The inside of this machine was one of the tidiest. It is well laid out, with plenty of room to find your way about in, and with all wires and leads well secured.

The keyboard is an AT style keyboard with 84 keys. This, of course means that some of the usual keys have been shifted onto the numeric/cursor keypad; but it only takes a few minutes to adjust to the new key positions. There are three LED's at the top right of the keyboard. These are caps lock, num lock and an LED for power as well. Functionally the keyboard behaves very well, and seemed to be good enough, although the keys did feel slightly too light to the touch. There are

two adjustable feet on the keyboard, and while these did adjust the keyboard, they are not very well made and would not take too much strain. The review machine was supplied without a monitor, but was tested with both a Taxan III Super Vision and a (hard working) Sakata.

System software

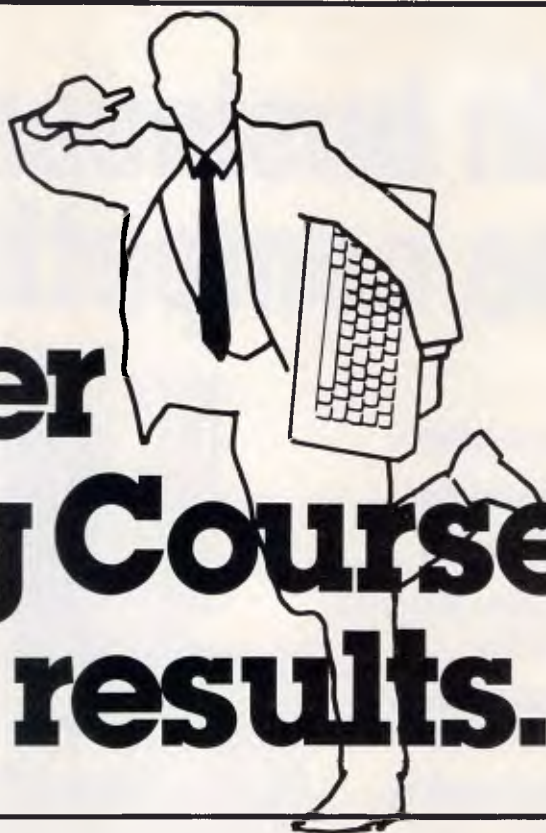
Power up on this PC/XT is reasonably fast, so presumably the turbo version will be extremely fast? The sign on message reveals that this is yet another Bios, written by Phoenix (which assures a good degree of compatibility), version 2.27. Under the sign on message is another company, Yangtech Inc, presumably it has copyright on something but exactly what is not made clear at all.

The version of DOS supplied with the Atlantis PC/XT is Microsoft MS-DOS 3.10, modified by Falcon Technology, so it is not a straight version of MS-DOS. However, this version of MS-DOS will run all the standard IBM PC software. Atlantis or Falcon Technology have included a few extra DOS commands, with this otherwise standard MS-DOS. These include: BADSPOT which allows the user to enter a list of defective areas on a hard disk. MOVE which allows the user to move files from one directory to another. RECOVER which attempts to recover a file or an entire disk, and will return the number of bytes successfully recovered. RENDIR will replace the old directory name with the new one, (normally under MS-DOS this is a very lengthy procedure). WHERE is used to locate files on a disk (wildcards are allowed), and is very handy to find out where particular files are and how many versions are on the disk. And lastly, FC which will compare the contents of two files and output the differences to the screen or to another disk.

Also on the disk was a utility called, DR. There was no entry in the DOS manual for this utility, but there was a file on the DOS disk explaining its function. It is basically a pseudo drive utility that can be set up as an ordinary RAM disk, or can take over one of the existing drives. Therefore, you can have a real drive C and a pseudo drive C, and toggle between them.

The dip switches on the system board must be set for extra drives if you are going to set up drives that are not physically there. In essence, it is still a RAM disk, but is much more flexible and is easier to use (once you have set the dip switches). The DR utility also allows single or double sided drives, custom

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capacity (in kilobytes), and custom format.

Compatibility

Although this PC was not a Turbo, it is completely compatible. It not only runs the heavyweights in business software (ie. Lotus, Base and Microsoft products), but also worked quite happily with the Norton Utilities, and many 'home grown' utilities. This is a fair test of standard Bios entry points, parameters and versions of MS-DOS on the Atlantis.

Documentation

No user manual was supplied, but there was a manual for the system board, and extra manuals for all of the expansion cards. While this is no substitute for a purpose written manual, all of the information was there, if you looked long enough. The 300 page MS-DOS User's Guide contained all of the information regarding MS-DOS, as well as a complete reference section for the commands. It is well written, with fairly

good examples throughout. Unfortunately, the MS-DOS manual comes in a ring binder with an external cover, and the binder is not very strong.

A manual on GW Basic was also supplied, but GW Basic was not actually on the DOS disk. The GW Basic manual is well written, and well bound, but has no index, and one is needed in this particular manual. There were several other manuals for the system board, the keyboard and the expansion cards. These are just functional manuals, and are not meant to be guides or reference manuals.

Atlantis also include a PC Tutorial with all PC's, and it is well worth having for users who have never sat in front of a PC before. The tutorial is on floppy disk and uses menus to take the user through a great number of PC features. Atlantis also include two books: Personal Computer which is a general overview of PCs, and concentrates mainly on IBM PC's, and MS-DOS which is an overview of the Microsoft disk operating system. Both books are of value and impart information that most users would otherwise never have.

Prices

The Atlantis PC/XT with twin 360k floppy disk drives, 640k RAM, a multi-function card, disk controller, colour graphics adaptor, keyboard, MS-DOS version 3.10 and the PC Tutorial, sells for a recommended retail price of \$1695. Remember that this does not include a monitor or hard disk drives. The turbo version will retail for \$1845, and will have the same RAM, drives and cards.

Conclusion

At first sight this PC looked a little long in the tooth compared to other PCs. However, given Atlantis's 15/30 minute repair or replace guarantee, the 12 month warranty, the low price and the performance of the machine, it would appear to be competitive. Add to that the fact that for an extra \$150, there will be a turbo version available soon, with a processor capable of an 8MHz clock rate plus the fact that Atlantis seem to think of all of the extras you may need. This company and its range of PCs may well fit your needs.

Kaypro PC

The Kaypro PC is Kaypro's new turbo version (released October 1, 1986), and is manufactured and assembled in the US. Its dimensions are 48cm x 40cm x 13cm for the main unit. The casing is a combination of light and dark cream colour.

The configuration supplied for review was the main unit with 768k RAM, colour graphics adaptor, parallel port, serial port, real-time clock, speaker, and twin floppy drives, with keyboard and monochrome monitor. This is Kaypro's base level machine.

Hardware

The front of the review machine has two Mitsubishi 360k floppy drives, Kaypro's label on the far left, a keyboard lock to the right of the label, and next to the keyboard lock two LEDs. One of the LED's is the power indicator and the other is not connected, (probably a hard disk LED).

The rear of the machine had a little surprise in store — nine expansion slots. Below the ninth expansion slot is the keyboard DIN connector, and next to the



expansion slots are the fan cover and the power supply, with an AC outlet and an AC inlet.

Opening the box was just a matter of removing a few screws; but getting the lid off was a little awkward, as the leads from the disk controller to the drives have been secured along the top of the disk cabinets, and tend to catch on the lid when you try to remove it.

As mentioned earlier, there appear to be nine expansion slots, rather than the usual eight. In fact while there are nine expansion slots the ninth slot has a built-in face plate, rather than the usual removable bracket. This makes it useful for boards with D connectors, such as a parallel port, or for use with boards that have extra connections for serial, parallel and games ports and take up an extra slot. In any event, it is a usable ninth port.

The next surprise was the system board. There did not appear to be very much in sight, but on closer examination one discovers that the system board is in fact mounted on a card, and there goes the extra expansion slot. However, this is a good idea as the theory is that the base machine can have its system board upgraded whenever Kaypro make its next advance in PCs. This is exactly what Kaypro intended, and in fact it has recently been promoting this PC as an infinitely upgradable machine.

The expansion cards which come as standard are the system board, with an 8088-2 (Kaypro has just changed this to an NEC V20, switchable between 4.77MHz and 8MHz) which runs at 4.77MHz and is hardware switchable to 8MHz. There is a spare socket for an 8087 coprocessor and Kaypro's Bios, and one bank of dip switches with five settings.

There seemed to be no information on the dip switches but they seem to control the usual system tests on power up, plus the type of monitor and drive configuration.

The next board is a colour graphics adaptor. Again, no technical information was supplied, but the board will accommodate either mono or colour monitors. The type of monitor present is controlled via dip switches on the colour graphics

board and on the system board.

The third and final board was a Kaypro multi-function board with a parallel port, a serial port, plus the RAM and also acted as a controller for the floppy disks. The monitor supplied was also Kaypro's and was a monochrome monitor. Very simple, but is an easy monitor to work with, and is flicker free and very clear.

There is space for four internal drives in this PC. This machine had two floppy drives, but Kaypro sell a PC with a 20Mbytes hard disk and one floppy, and would presumably supply a system with two floppies and two hard disks. If not, it is an easy matter to pick up drives and install them. Most hard disks are manufactured by three of four companies and other companies simply buy them in quantity and put their own brand name on them. Any reputable PC dealer will supply you with a hard disk and controller, plus utilities, if needed. It should only take a few minutes to install one, and will cost you less.

One final point to mention concerns the turbo switch and the reset switch. These switches are fitted to the rear of the unit and are connected to the system board (on an expansion card). The reset switch performs a complete reset, and the turbo switch is used to change the clock rate between 4.77MHz and 8MHz. Both switches are easy to locate, but you will still need to lean over the box to reach them. Some users prefer switches to be within reach at the front of the unit, but that depends on the size and shape of the switch. These switches are safer at the rear of the unit out of the way of flying objects.

The keyboard once again is AT style, with 84 keys. In fact, it looks identical to the AT keyboard. It is a solid keyboard, with a large Enter key so that no one can miss it. Above the numeric/cursor keypad are three LEDs which indicate the depression of, the Caps Lock, Num Lock and Scroll Lock, and we also find the Sys Req key which is not currently utilised on PCs. Not only is the main keyboard solidly built, the keyboard lead is also of good quality, and the connector is made of metal rather than moulded plastic. The keyboard lead is also longer than most, allowing you to sit back with

the keyboard comfortably on your lap. The only quibble is the light feel of the keys, but they seem to work well, and in any case, with a 12 month warranty (as opposed to, three or six months with most compatibles), you can always take it back and complain.

System software

The Kaypro PC comes with an astounding amount of software; far too much to review in depth, but all of it will be at least touched upon. On power up, the sign on message informs us that the Bios is written by Phoenix. The time that the RAM tests take is not impressive, but it is not a very long wait. The first thing to note is the inclusion of an extra 128k RAM. Kaypro call this 'hidden RAM', meaning it is not accessible to ordinary MS-DOS programs. The extra RAM sits from D0000 to EFFFF hexadecimal which gives an extra 128k RAM. Kaypro has provided an extra driver called, 'RAMDISK.BIN', which sets up a RAMdisk in the extra RAM. This is very handy, although 128k is not very much for a drive, as MS-DOS gobbles up about 5k for the FAT (File Allocation Table), leaving 123k for the user.

The version of DOS is MS-DOS 3.20, which has recently been released by Microsoft and has some new features, and in general, seems to be slightly faster, which is a bonus. Also included is version 3.20 of GW Basic, apparently much the same as version 3.10. The majority of MS-DOS 3.20 commands are the same as version 3.10, but the

Benchmarks

BM1	0.9
BM2	2.9
BM3	5.5
BM4	6.3
BM5	6.9
BM6	12.2
BM7	18.9
BM8	20.1
Average	9.2

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

To find out how to link IBM PCs and run more software on your network, turn to page 12



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Digital Equipment VT52, VT102, VT220	
Hazeltine 1400, 1410, 1500, 1520	
Hewlett Packard 2622A, 2624B*	
Honeywell VIP 7205, 7801, 7803, 7813*	
IBM 3101 Model 10 and 20, 3161*	
Lear Siegler ADM-2, ADM-3A, ADM-5	
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New Release 1986

Additional protocols available in the 2Q86 release of Softerm PC will include KERMITE (the public domain protocol developed at Columbia University), Hayes Verification Protocol (Smartcom), and CLINK (Crosstalk).

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following commands are of particular interest: **FORMAT** which has been slightly revamped and will prompt you for the volume label of the disk; **REPLACE** which allows the updating of files from one disk or directory to files on another disk, or in another directory; **XCOPY** which is used to copy files in the same way as the standard copy command, with the addition of several switches that will search the current directory and all lower directories for the file(s) specified (wild cards are allowed).

Applications software

Kaypro include a number of packages with its PC. The first is Mite, which is a powerful communications/file transfer program, functionally very close to Crosstalk. Mite is very flexible and easy to use. Like Crosstalk it can be used to connect to most commercial networks or as a terminal of a mainframe, and as a file transfer system between PCs.

Kaypro has also included a program entitled, Catch, which can be used to capture data sent from another micro, using Mite. Of course, you will need to hook up the two PCs with a lead connected to the serial ports; but having done that, it becomes a very simple matter to transfer these files. Catch can also be used to capture data from other micro's, as it uses the standard XModem protocol.

The remaining packages include WordStar version 3.3. WordStar is the very famous word processor that originated on 8-bit micros many years ago, and is still selling and being used by the computer wise and the novice alike, so it must have a great deal going for it. Also included with WordStar is a spelling checker called CorrectStar and an index program called, StarIndex. CorrectStar is for use with version 3.3 of WordStar, and comes with an extensive dictionary. StarIndex is a useful utility that enables the user to create a complete index, a contents list, a list of figures and a list of tables.

Lastly, Kaypro include a utility entitled Polywindows, which is a desktop utility in the style as Sidekick. It provides a document editor, keyboard enhancer, calendar, an alarm clock, calculator, a dialler, a cut and paste facility, and as a diversion (if you need one), a puzzle. The program is memory resident, so one should check thoroughly that it does not interfere with other programs.

Compatibility

Not all of the standard packages were tried on the Kaypro, but WordStar

performed extremely well as did several other word processors. Not really surprising, as the version of DOS supplied is a straight MS-DOS, even though it was version 3.20. It is also worth mentioning that the Kaypro comes bundled with so much software that it may be a while after purchase that you will actually require other commercial packages.

Documentation

No less than eight manuals are supplied with the Kaypro PC. All of them are written by Kaypro and are very well presented, well written and are clear and precise. This makes setting up and using the system as simple as possible. The User's Guide is short, but it does contain all of the information needed to set up the system and it covers all major components of the machine in some depth. This includes a short but very useful memory map which enables programmers to see at a glance how Kaypro has utilised the memory. Also included is a handy troubleshooting section, and technical information on the ports. The manual is rounded off with an ASCII chart in decimal and hexadecimal, giving the values of attributes and the equivalent keystroke(s). Of course, there is the expected index in this manual, as in all of the other Kaypro manuals.

Kaypro's MS-DOS manual is equally well written and covers all you will need to use MS-DOS 3.20. The same can be said of the remaining six manuals. They cover all aspects of the bundled software, and make the task of finding your way around the software fairly simple.

Prices

The Kaypro PC with 768k RAM, parallel

port, serial port, real-time clock, speaker, eight expansion slots (nine, but you must use one for the system board), colour graphics adaptor, an AT style keyboard, twin 360k floppy drives and an amber monitor, sells for a recommended retail price of \$2725. Kaypro will sell the system without the monitor for \$2395. A system with one 360k floppy and a 20Mbytes hard disk sells for \$3425, or for \$3095 without the monitor. Kaypro will provide a colour monitor as an option and, of course, all of the aforementioned software is included with the Kaypro.

Conclusion

Considering the reasonable price of the Kaypro PC, the amount of usable software bundled with the machine, and the good performance, it is an attractive PC for home or for the office. One must also take into consideration the 12 month warranty offered by Kaypro and the fact that it has been in the micro business for some time.

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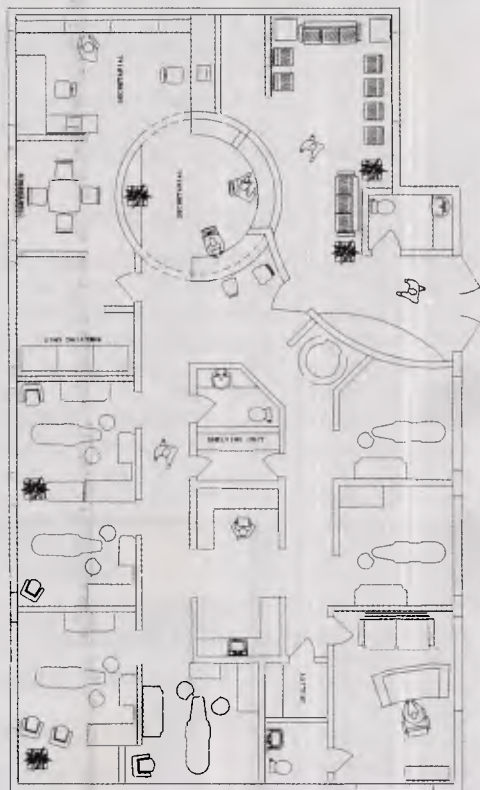
Technical specifications

Processor:	Intel 8088-2 running at 4.77MHz, hardware switchable to 8MHz (NB Kaypro has just changed the processor to an NEC V20, running at 4.77MHz and switchable to 8MHz)
RAM:	768k
ROM:	8k
Keyboard:	Detachable 84 key AT style keyboard including 10 key numeric/cursor pad and LEDs for Caps Lock, Num Lock and Scroll Lock
Display:	Optional Kaypro monochrome or colour monitor
Weight:	Main unit 14kg (twin floppy) Keyboard 1.2kg
I/O:	Parallel port, serial port, real-time clock, speaker, eight expansion slots, colour graphics adaptor and power sockets.
Mass Storage:	Either 20Mbytes hard disk and one 360k 5.25in floppy, or two 360k floppies
DOS:	MS-DOS 3.20

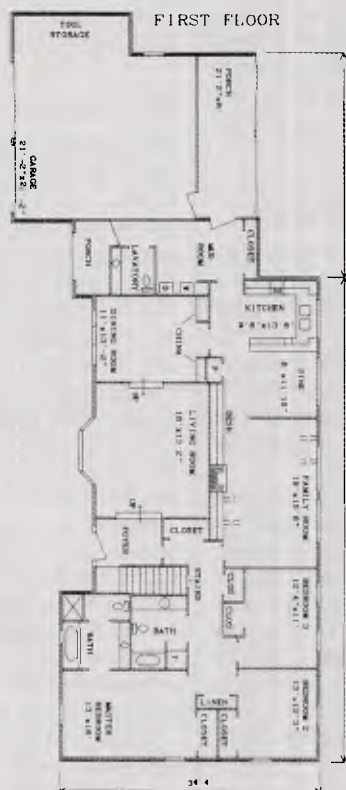
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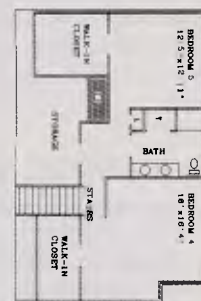
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Olivetti M24SP

Hot on the heels of the Olivetti M24 Olivetti released a PC Plus. The M24 has one of the best reputations of all PC-compatibles, so the M24SP will be a much looked at machine, and if it comes up to expectations will do well in the PC marketplace.

The Olivetti M24SP is another compact unit, although the physical dimensions are greater than the Epson PC Plus and the Leading Edge PC. The main unit measures 38cm x 16cm x 37cm, the monochrome monitor is 33cm x 26cm x 31 cm. This is slightly bigger than some of the other machines reviewed, but you do get more for your money. The M24SP colour scheme is a very attractive combination blue-grey and dark grey. The base level unit is a single 360k floppy and a 20Mbytes hard disk, with a 12in monochrome monitor and standard keyboard with an integrated mouse connector, which was the configuration used for this review. This combination should satisfy most needs, though a fourth M24SP with a larger hard disk would not be a bad move.

Hardware

The front of the unit is well laid out. From right to left are two disk cabinets. The top one is the hard disk cabinet, and instead of the usual black cover with the red indicator, Olivetti has fitted a red perspex cover so that the drive light is easily visible from a distance. It also looks a lot better than the standard black panel. Directly below the hard disk is the floppy disk and below it are the power indicator and the reset button.

The rear of the machine seems to reveal eight long expansion slots (one has the alphanumeric and graphics display controller in it, which leaves seven expansion slots, but one more is taken up by the hard disk controller board so now there are six) and again we find, as standard, two more ports.

The ports are all conveniently labelled in clear type. Looking at the back of the machine from left to right are: the power switch, AC inlet and the AC outlet, and a D connector for the keyboard. Moving left is the fan (which is very bulky), eight expansion slots and the parallel and serial ports. Once again, the power sup-

ply and the fan are housed together very compactly.

Taking the lid off the Olivetti M24SP was very straightforward. There are three screws to undo, but you do not have to remove them, only loosen them. Having removed the screws the lid simply slips away and so does the bottom of the unit. The system board is actually underneath the main unit. Olivetti has done this so that, unlike some other PCs, the M24SP system board is easily accessible.

Having removed the cover, the expansion slots were in clear view, as were the power supply and the fan. Most of the major ICs were socketed which is convenient and very pleasing.

In keeping with all the other features of the Olivetti M24SP, the system board is extremely tidy and is easy to find your way around. The processor is an Intel 8086 running at 10MHz. The 8086 is of course totally compatible with the Intel 8088, and all software written for the 8088 will run on the 8086. The only difference is the speed. This 8086 runs over twice as fast as the standard 8088 (as found in the IBM PC/XT) and, of course, has a 16-bit data bus, as opposed to the 8-bit data bus on the Intel 8088. There is an IC for a coprocessor

(an 8087). Surprisingly, there are no custom chips on the board, which makes replacement very simple, and there was only one ROM (the Bios). The firmware was undoubtedly developed for, or by, Olivetti, and supports PC applications.

The standard memory on this PC is 640k, which is sufficient for most PC applications, although an extended memory board can be added. As you would expect with such a small machine there is no extra room inside for a second hard disk, or a streaming tape drive. Although again one presumes that larger hard disks can be fitted, not forgetting the limitations of MS-DOS (32Mbyte). There are two banks of dip switches controlling the installation of additional memory, onboard ports, coprocessor and other installed options.

The M24SP comes with a standard PC 83 key keyboard, but that is where the similarity ends, as this is a deluxe model. In use, it is astoundingly hard to hit the wrong key because Olivetti has built the board with enough space between the keys. The keyboard response is the best these fingers have had in eight years of tapping on keyboards. The Num Lock and the Caps Lock keys have LEDs so you can tell whether they are on or off, and finally, there is a port at the rear of



the keyboard for a mouse. The actual mouse is an option, but at least you will not need to buy an extra card and lose another expansion slot, when installing it. As an option Olivetti will supply a 102 key detachable keyboard, with an extended numeric pad. This keyboard also has separate cursor control keys, and eighteen terminal style function keys along the top of the keyboard.

The monitor supplied was a 12in monochrome, but Olivetti will supply a colour monitor. The colour monitor has an onboard socket, but the mono monitor plugs into the monochrome card which occupies the eighth expansion slot. The characteristics of the monitors are the usual 80 or 40 x 25 in text mode or 640x400, 640x200, 320x200 pixels in graphics mode. Both monitors are fitted with a tilt swivel, and the mono monitor can produce 16 shades of base colour, while the colour monitor can produce 16 colours.

System software

When the system is first powered up, no copyright message displayed, and then the machine performs a comprehensive set of tests, including controllers, RAM and drive tests. The drive tests take a long time, but this is the only thing that is anything like slow about this machine.

The version of DOS supplied for review was MS-DOS 2.11, but the M24SP will also run Xenix II, Concurrent DOS and UCSD p-System. Olivetti supplied five disks. They were: the MS-DOS master disk, two 'getting to know the M24SP' disks, a keyboard driver and utility disk and a customer test disk. The 'getting to know disks' contain a very sophisticated tutorial managing to show the power of the machine and guide the user around it at the same time. The utilities disk has a large range of keyboard drivers, and Olivetti's version of GW Basic. This was marked 'demo' and was version 2.01. The customer test disk is a diagnostics disk.

All of the expected commands were present in this version of MS-DOS, with several additions and differences such as:

EDIT, a video file editor which is far superior to EDLIN; HEXDUMP which will produce a hexadecimal dump of any file created with MS-DOS; and X which is Olivetti's version of XTREE and is a menu-driven utility which gives statistics on the current disk. It also allows you to move around the sub-directories and manipulate files or execute programs.

Compatibility

As one would expect from Olivetti, the M24SP has been released as a fully compatible machine and all of the tests mentioned for previous machines apply to the M24SP as well. Although the use of MS-DOS 2.11 does put some limits on the machine, it did all that was expected, and one would expect Olivetti to be releasing this PC with a later version of MS-DOS to rectify the situation.

Documentation

The Olivetti M24SP is supplied with three manuals, all written by Olivetti and are reasonably presented. The first

manual is called Installations and Operations Guide which explains how to set up the M24SP, and goes into some depth. It has a good index, and in practise, this will be the manual used while the user becomes familiar with the machine.

The second manual, MS-DOS User Guide, is a large manual, (ten chapters and six appendices) and is by far the best of the three. It is well written, with clear explanations of commands, accom-

Benchmarks

BM1	0.7
BM2	1.9
BM3	3.5
BM4	3.9
BM5	4.2
BM6	4.3
BM7	11.5
BM8	12.8
Average	5.3

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 8086 (16-bit), running at 10MHz
RAM:	640k
ROM:	16k
Keyboard:	Two different keyboards are available: (i) standard 83 key detachable keyboard with 10 key numeric/cursor keypad (ii) 102 key detachable keyboard with extended numeric keypad, plus separate cursor control keys and 18 terminal style function keys (along the top of the keyboard).
Display:	Colour graphics adaptor, providing colour output with a swivelling monochrome monitor (colour monitor optional)
Weight:	Main Unit 14kg Keyboard 2.1kg
I/O:	Colour/mono monitor output, parallel printer, serial port, real time clock, speaker, seven full length expansion slots, onboard floppy disk controller, hard disk controller (occupies one expansion slot) and power sockets
Mass Storage:	20Mbytes hard disk and one 360k 5.25in floppy
DOS:	MS-DOS 2.11, but will also run Xenix II (Microsoft's Unix-like multi-tasking, multi-user operating system), Concurrent DOS and the UCSD p-System

To find out how to link IBM PCs and share all hard discs, printers and modems, turn to page 12



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- **SAMSUNG 12"** **\$205**
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- **SAMSUNG 12"** **\$260**
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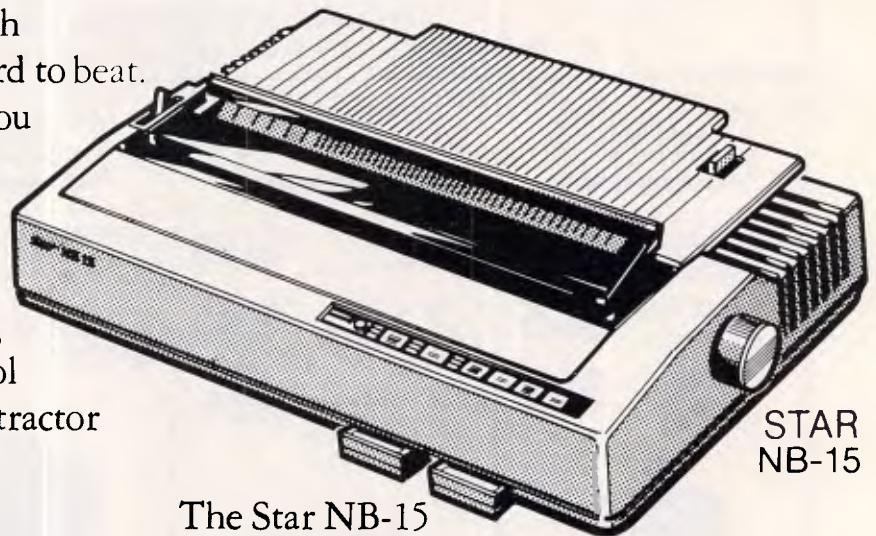
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panied with good examples. This is a clear and precise, if exhausting in length, MS-DOS manual. Though once again there could be more technical information on MS-DOS, particularly as Olivetti's version differs from the Microsoft versions.

The third and final manual is, MS GW Basic under MS-DOS. Once again this is a very comprehensive and well written manual, taking the user through every aspect of GW Basic. It includes sections on programming, learning, the keyboard under GW Basic, file handling, graphics, communications, a full command reference section, error messages, all the usual conversion and reference tables, program conversion, a handy technical reference section, a memory map and finally, the well used and much needed, comprehensive index.

Prices

The Olivetti M24SP is available as a base level machine with the main unit: a standard PC/XT keyboard, 640k RAM, parallel and serial ports, six free expansion slots, real-time clock, two video ports and one 360k floppy disk and a 20Mbytes hard disk has a recommended retail price of \$7325. The various options are: colour monitor, 8087 coprocessor, 8530 communications kit, BSC SNA communications board, LAN boards, 20Mbytes hard disk, 102 keyboard and 10Mbytes streaming tape back up.

Conclusion

The Olivetti M24SP is by anybody's standards, in a class of its own, from the

10MHz Intel 8086 processor through to the polished finish and appearance of the machine. Anyone wishing to buy a very good stand-alone PC could not do any better. However, it was surprising to receive MS-DOS 2.11 with the machine, instead of version 3.1 or even the new 3.2. Perhaps Olivetti will release a new version of MS-DOS in the near future. The fact that it supports Xenix II is a bonus as this will encourage other hardware manufacturers to go the same way and eventually we may get to say goodbye to MS-DOS. The M24SP hardware and software design and documentation caters for everyone from the novice to the experts.

It is very difficult to say anything critical about this PC. Even compared to other PC Plus machines — it outstrips them all.

Profound PC/XT Turbo

For those familiar with PCs, you would be forgiven for mistaking the Profound for a PC/AT at first glance. Looking a little closer reveals some of the differences, but nevertheless the unit looks much like an AT. The machine is supplied by Eastern Micro Electronics (EME), the distributor for the Profound PC/XT Turbo. The base level machine includes 640k RAM, twin 360k floppy disk drives, a PC/AT style keyboard and a colour monitor. The PC/XT Turbo is EME's mid-range machine. At the bottom of the scale it has a standard PC/XT and the top of its range is a PC/AT.

The Profound PC/XT Turbo is fashioned in an unoffensive combination of grey and cream. The shape, size and colours of current PCs all look so familiar, in fact, Big Blue has recently warned several compatible manufacturers about the similarity of design to its PCs. One wonders if we will soon see compatibles labelled, 'approved by IBM'. Although the casings of the machines get to look drab, being all so similar in design and colour; the technology and competition involved are certainly healthy for end users.

Hardware

The Profound PC/XT Turbo, certainly marches down the road of the clones, but offers quite a bit of power on the way. The name badge, barrel lock (which actually does lock the keyboard unlike some locks which just seem to be there to decorate the machine, or to keep up the IBM appearance), disk and power on indicator lights at the left hand side of the front panel even look like the AT. The disk and power indicator strip also include a reset button and a button marked Turbo which is to switch the Intel 8088-2 between 4.77MHz and 10MHz. The two disk cabinets contain two half height 5.25in, 360k Mitsubishi floppy disk drives. The power switch is on the right hand side of the machine and is the standard IBM PC power switch.

The back panel of the unit reveals the eight expansion slots: one of them for a short board, and seven will take long boards. To the left of the expansion slots are two openings. These are for multi-function boards with extra parallel, serial, games or video ports. Below the extra D connector sockets, is the DIN socket for

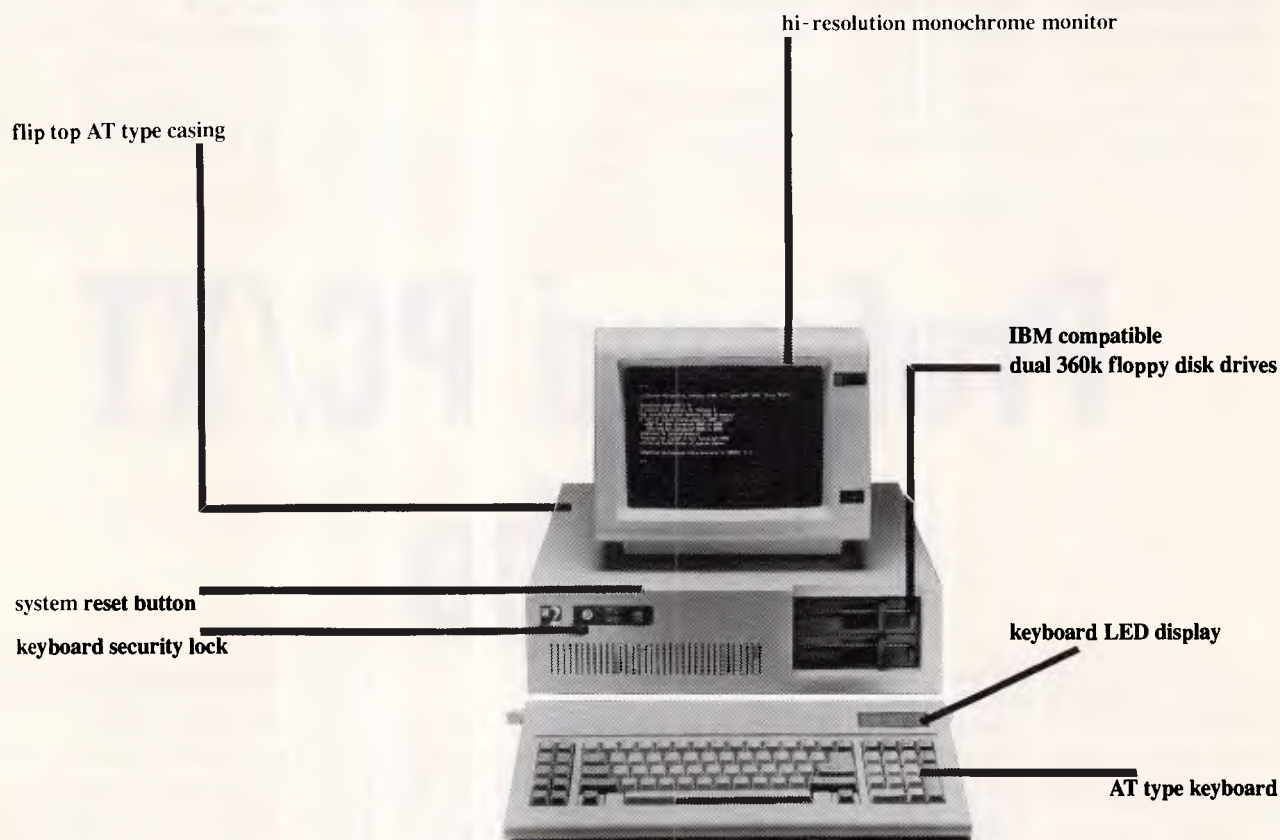
the keyboard, and finally to the left of the DIN socket, are the fan cover, the AC outlet and the AC inlet.

On this machine there is no need to remove the cover. It has two large silver studs, one on each side of the front of the unit, and one simply presses these and the cover slides up and is held up by two brackets, in much the same way car bonnets are supported. Anyone going out to look for a PC with the intention of installing cards themselves will save a lot of time and aggravation by getting a PC with a lid that simply opens.

Having opened the lid, the inside looked well put together and almost tidy. There was one wire which should have been secured, although it was not in any danger of causing damage to machine or people. The power supply is standard 135 watts and the fan is housed along with it. Of the two full height disk cabinets, one was occupied by the two Mitsubishi 360k floppy drives, the other one was empty. However, Profound will supply configurations with one or two half height 20Mbytes hard disks, or if you prefer it will supply hard disk capacities starting at 10Mbytes going

meet

HAL



HAL 2 Standard Configuration

Processor: Intel 8088-2 4.77/8MHz (switchable)

Memory: 640k, all IC in sockets

Storage: dual 360k FDD

Monitor controller: Hercules/color

Multi I/O: parallel, serial (2nd optional) and games ports,
real time clock, disk drive controller

Keyboard: 84 keys with LED indicator (AT type)

Power supply: 150w power supply

Case: flip top AT type

Monitor: TTL monochrome/color

Operating system: fully licensed MS-DOS

Warranty: 12 months

20MB Winchester (optional): Tandon

Dealer enquiries only: contact Michael Wee 02 516 5573

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up to 140Mbytes. The 140Mbytes would be very nice, but not practical on PCs, as current versions of MS-DOS will only support up to two 32Mbytes fixed disks. Profound will also fit the Profound PC/XT Turbo with 1.2Mbytes floppy disk drives, to give the machine more power.

The system board contains the usual array of support chips and an Intel 8088-2 processor, running at 4.77MHz and, according to Profound, switchable to 10MHz. While the Profound does romp along at a decent speed, it did not seem like a 10MHz machine. Perhaps the RAM, support chips or the Bios is slowing the processor down. In fact, Eastern Micro Electronics is looking at faster RAM and different support chips, so we will soon see an even faster Profound PC/XT Turbo.

The IC for an optional coprocessor is situated next to the 8088-2 and above the processor is the system dip switches, controlling peripherals and power up tests. There are two ROM sockets on the board, one contains the Bios and the other was empty (for Basic or some other utilities). It was good to see that all of the main chips, support chips and RAM chips were plugged into IC sockets, so replacement is a quick and easy task. In fact, the system board looked extremely well built and all components were reasonably easy to reach.

Three of the expansion slots were occupied on the review machine. Two of them were taken up with expansion cards, and one was occupied with a 25 pin D connector, which was hooked up to a multi-function board. This board acted as a controller for the floppy drives and also had a parallel port, a serial port, a games port and the real-time clock. The other board was a colour graphics adaptor with a connector for a colour monitor and phone connectors. This card will drive a colour monitor or a monochrome monitor.

EME supplied an Eizo 8030H colour monitor, which is an excellent monitor with a clear, crisp output. It has the usual hold, frame, contrast and brightness, plus a knob to change between colour, amber and green output. The monitor has two sockets one for a DIN connector and one for a 9 pin D connector. It seemed to be almost as good in operation as the Taxan range of monitors, and is inexpensive if one compares current prices and quality offered by other manufacturers.

The keyboard is PC/AT style. It is detachable, and has 84 keys, with LEDs for the, Caps Lock, Num Lock, and a power indicator. The Enter key is large enough for the biggest fingers and is labelled. Being an AT style keyboard, it

takes a little while to find some of the keys, as they have been moved to the standard position for an AT keyboard, but after one adjusts to that, the keyboard is responsive, well made and very easy to work with.

System software

The sign on message at power up reveals that the Bios is written by SPC ERSO and is version 2.19. The systems tests are fast (even faster if you switch to turbo) and in no time at all DOS has loaded and the machine awaits instructions. The reset button will only work when the processor is running at 4.77MHz, so the turbo mode needs to be disabled before the machine can be reset.

The version of MS-DOS is 3.20. It is a straight Microsoft version, complete with Microsoft manuals (which have improved dramatically recently). MS-DOS 3.20 is on two disks. The main disk contains the system files and commands, and the second disk contains GW Basic, Microsoft's Linker (version 3.05), Debug and the remaining DOS commands (the main disk was full).

Users who have had previous experience with MS-DOS will not feel lost with this new version. Even those who date back to version 1.xx will still

find familiar commands. However, this version of MS-DOS does have some differences, mainly in the commands available. The general performance did seem better than previous versions and there are several new drivers (not really so new, but now included as standard). There were rumours that Microsoft has versions 4.0 and even 5.0 of MS-DOS, but when questioned claimed that a special version of MS-DOS (version 4.0) was sold to another company and MS-DOS version 5.0 does not exist.

Compatibility

The Profound is now in use in many different areas and one would expect it to be extremely compatible. While dBase, WordStar and Lotus actually all performed well, the machine was prone to hang occasionally. It is not clear if this was due to the software running, or to some other fault, but in any event the occurrences were few and far between (perhaps a port conflict).

Documentation

EME provide three main manuals. The first is the User's Guide and is written with exactly the same format as the IBM User manual. One difference is that EME has opted for a bound manual, rather than a ring binder. The manual covers everything the user will need to know to get going, and has useful sections on the installation of options. The User Manual is finished with a good index, so that you will have no trouble locating the topics covered.

The remaining two manuals are supplied and written by Microsoft. The first is the MS-DOS Reference Manual, which is 340 pages long. (Both manuals are in ring binders, which has advantages and disadvantages).

Benchmarks

BM1	0.8
BM2	2.9
BM3	5.5
BM4	6.3
BM5	6.8
BM6	12.3
BM7	19.0
BM8	19.7
Average	9.1

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 8088-2 running at 4.77MHz and switchable to 10MHz via button on front panel
RAM:	640k
ROM:	8k
Keyboard:	IBM AT style, with 84 keys, detachable, with lights for, Caps Lock, Num Lock and Power
Display:	Colour graphics adaptor, driving an EIZO 8030H colour monitor. The monitor was switchable between colour, amber and green
Weight:	Main unit 12kg Keyboard 1.2kg
I/O:	8 expansion slots, speaker, parallel port, serial port, real time clock and a games port
Mass Storage:	Twin 5.25in 360k Mitsubishi disk drives
DOS:	MS-DOS 3.20

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PC-COMPATIBLES

The first manual, covers all of the DOS commands and has sections on batch files, error messages, file handling, Debug and Edlin. It is a well written manual and is easy to follow and easy to use, and, of course, Microsoft has included the invaluable index.

The second manual covers the well worn topic of Basic — GW Basic version 3.20. The manual has no index, but is designed well enough to find your way around without any problems. Like the other manuals, the content is well presented and clearly written.

Prices

The base level Profound Turbo PC/XT

includes: keyboard and the main unit with 640k RAM, multi-function board with one parallel port, one serial port, one games port, real time clock and a disk controller, video card colour or mono graphics (colour on the review machine), twin floppy 360k disk drives, and an Intel 8088-2 processor (4.77MHz-10MHz). It has a recommended retail price of \$2150. The EIZO colour monitor is an extra \$860, and MS-DOS 3.20 will cost another \$150. However, EME will sell all of the above (if bought in a package) for \$3030.

Conclusion

Eastern Micro Electronics claims that

some of its major clients include: CSIRO, Alcoa, Telecom Australia, National Mutual Royal Bank, BHP and Godfrey Hirst. This is not really very surprising, as it has an elegant and robust PC to offer.

It will run all of the standard IBM PC software (most of it a lot faster than other PCs) and EME has put it on the streets at a good price for the performance it gives.

SUMMARY

Most PCs today are using outdated technology and it is in part due to users and the business community hanging onto well-tried, well-tested and well-supported technology. However with the recent success of 68000 based machines users could be using machines that are far more powerful, easier to program (less development time, means cheaper software) and are capable of all the users' needs as a standard machine.

Time now for the final judgement. You will have by now gathered a fair amount of information on each of the PCs included in this section. However, not a great deal of emphasis has been placed on comparisons. There are a few points to take into account when comparing these PCs. The main points are: price and power (power per dollar, you might say). Other important features are, compatibility with existing software, reliability, support, ease of use and last but not least the technology used.

While the 9 machines reviewed here are a mixed bag, they do all claim one thing in common, that they are compatible with the IBM PC. For the best part they are compatible, and one only has to choose a machine and hand over the money.

An appropriate way of deciding is to run through each machine and note its merits, hopefully coming up with a PC that stands out from the rest. The first one on the list is Basic Time's BTurbo PC. It is a turbo machine and the Benchmarks do suggest that it is relatively fast, but the documentation for this system is badly written and the keyboard is not too good.

The Leading Edge PC does not come up to the performance of other machines here but it is a compact unit and would

perform well as a workhorse in the office or at home. Finally, its price puts it out of the picture unless you particularly want an expensive workhorse.

The Atlantis PC with 640k RAM and twin floppy drives (no monitor) at \$1695 represents good value for money. Although the Benchmarks for this machine are poor due to its 8088 processor, Atlantis offer good service and a 12 month warranty. It would be worth having a look at Atlantis's new Turbo PC due to be released shortly, which will sell for an extra \$150.

The Kaypro PC seems like a good choice: it is reasonably priced at \$2725 with twin floppies, 768k RAM and amber monitor, MS-DOS 3.20 and a lot of applications software bundled with the machine. Add to this the good Benchmarks and the reputable name and it would be a reasonable PC to buy. However, the machine was a little untidy, and its reliability is in question.

Eastern Micro Electronics has produced a well designed and solid PC in its Profound Turbo PC/XT. EME provide an excellent monitor and the main unit with 640k RAM plus a multi-function card, disk controller, twin 360k twin floppies and good performance at \$3030. The company is not yet big in the PC arena, however, it is well worth checking this machine out if you are looking for a PC.

The Epson PC Plus and the Amstrad PC1512 are attractive PCs with most features you would expect in a PC. However, the Amstrad PC1512 seems to have a few peripheral problems (ie must use the Amstrad monitor), but it is very inexpensive. The Epson on the other hand is over priced for the hardware, but of course it performs very well and would

not be the wrong choice. Likewise the Amstrad PC1512 would perform very well, just make sure that you check both of these machines before committing yourself.

The remaining two machines are the pick of the bunch here. The Cleveland PC II is good on sheer speed and power, but as it falls between a PC/XT and a PC/AT, perhaps it should have been included in the AT reviews. The 80186 running at 8MHz is tempting to programmers and enthusiasts alike, but the price is slightly too high for that range of users. For the business community this machine may well fill the gap between the AT and the XT as it is fairly priced at \$3262, but comes from a young company which has yet to make its presence felt.

The final question is, would you pay at least \$7325 for a PC. The answer, if the machine is the Olivetti M24SP, must be a resounding, yes. This machine has been carefully designed with physical appearance, compatibility, user requirements, speed and an overall elegance that makes it by far the best PC of those reviewed here.

It is not simply a matter of the processor clock rate, (although 10MHz is fast enough for current and future PC requirements), but also Olivetti has taken the trouble to produce a machine that has more than impressive specifications. The board has been designed so that the machine is as efficient as possible and the base level hardware fits with most current users requirements. Finally, one simply cannot ignore the fact that it is produced by one of the better known, among the most reputable and a well respected hardware manufacturer. Without a doubt Olivetti has produced a winner.

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A ★ Star II

Let's face it, if you're going for an AT machine, you're after high performance. IBM now has an 8MHz version of its machine, and so any vendor not offering at least 8MHz has got quite a way to catch up, and there is more than one vendor in precisely that bind. The A★Star II, however, goes like the wind, and does it at a very attractive price.

Hardware

The A★Star II can be delivered in several performance configurations, but the model provided for review was the 300 Plus, running an 80286 processor at 6, 8, 10 or 12MHz. The lower two speeds may be run either with or without wait states, and the top two are always run with a single wait state. The model 300 can only perform at 6 or 8MHz.

This machine is supposed to fight back against the virtual monopoly the Taiwanese have on the PC-compatible market. The beast is manufactured in the US by Wells American, based in South Carolina. However, poking around inside reveals a few skeletons in the family closet. More on that later.

Speed selection is performed using a supplied utility, and can be changed without a machine reboot occurring. Alternatively, I/O port 64 can be manipulated directly from a user program, which means it would be a simple matter to build a pop-up speed selector to cater for quirky copy protected software.

The motherboard is a very neat affair. Eight expansion slots are provided, comfortably spaced. Two of these are 8 bit slots, and all are full length. When shipped, three of the slots are occupied by a display adaptor card, disk controller and parallel/serial card. Chunky PLAs adorn the motherboard, explaining the tidy layout and relatively low component count. Most of the usual chips found in a PC or AT-compatible are conspicuous by their absence. The chips that are recognisable are Siemens devices manufactured under license from Intel.

Even the 80286 is a Siemens, with a rather alarming mounting technique. The 80286 looks like it is mounted under a heat sink clip, however when the clip and sink cover are removed, a featureless ceramic panel is all that is

revealed. Thinking this is another thermal cover for the processor lurking underneath, the prying reviewer hooks out the ceramic cover to find it is actually the rear side of a virtually naked 80286 CPU. Shock, horror, sweaty hands! The end result is an 80286 flying free in my hand, with virtually nothing on it safe to touch. Not a normal 80286 in a package with legs. Putting the CPU assembly back together without inflicting static damage is a little tricky, but then no-one in their right mind would have pulled it apart in the first place, had they known what it really was. It is a real credit to Siemens and the reviewers abstinence from nylon stockings that the A★Star II still operated after this major surgery.

Presumably this mounting technique allows the easy change over from 8MHz to 12MHz processors.

Two rows of vertically mounted memory chips provide the main system RAM. Each row contains 18 chips, and the two rows combine to provide a total 1024k of RAM as standard equipment. These vertically mounted memory chips

would seem to be a great idea, reducing the board area requirements by half. They look like normal 16 pin dip packages, except all the legs come out the same side of the package and are slightly splayed. The width of the chips at the bottom, including socket, is about three millimetres.

Naturally, a socket for an 80287 numeric coprocessor is provided, as are additional ROM sockets. The power supply is of the sealed box type, and can produce 200 watts. The power switch is located in the standard IBM position and thus compromises between easy access and accident prone prominence.

On the front panel, a standard AT panel is provided which includes a key lock, power and DASD access indicators. A second red LED from the hard disk drive can be seen glowing in the bowels of the unit. On the rear, a reset switch and local area network port are provided. Reset switches are a great idea, as they negate the need to power off during a complete system freeze and, as such, help to prolong the life and reliability of the equip-



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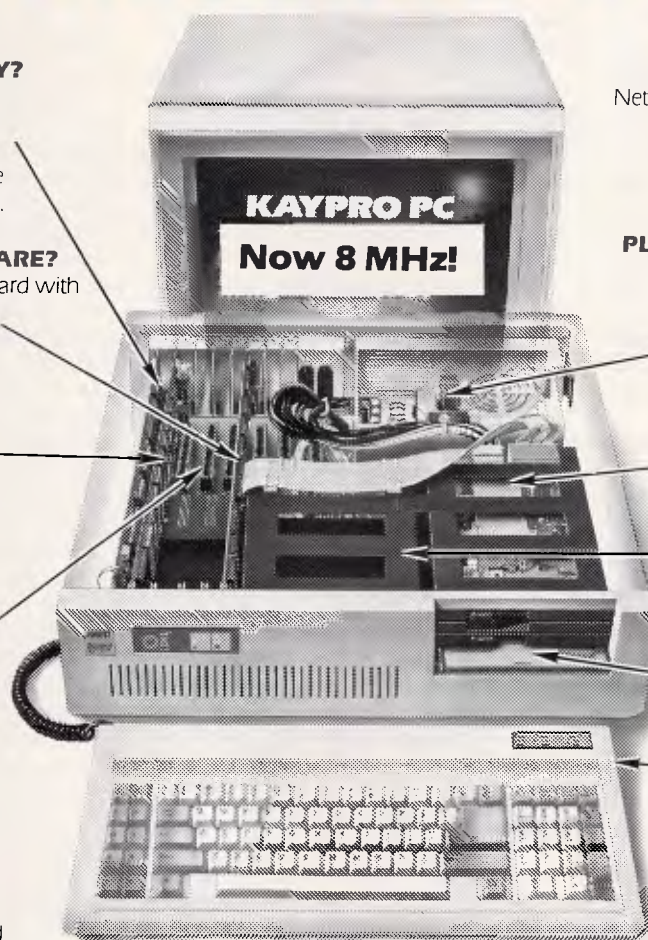
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ment. The LAN port is claimed to be 'network ready', which is a little cheeky, as a \$800 board must be added before the port becomes active.

The battery backed clock/calendar is powered by a bank of four Duracel dry cell batteries mounted on the inside of the rear panel, which means no problems finding exotic batteries in a couple of years time.

The floppy disk drive is a half height Japanese Teac device, and seems to be the only part of the system which doesn't fly. In fact, the disk isn't as slow as it seems, it's just that everything else goes so fast that the floppy appear to be rather sluggish. When run up against floppies on an Olivetti M24, you quickly realise that the perceived speed problem is just an illusion. The capacity is, of course, 1.2Mbytes.

Underneath the floppy is space for a second half height device and, underneath that, room for a third. The third spot, however, cannot be accessed with the cover on the unit, and so would only be appropriate for a hard disk or something similar.

The hard disk is a 30Mbytes voice coil with an average access time of 32ms. By way of comparison, the IBM PC/AT has a 37ms disk, so the A*Star II disk is quite fast. Other machine configurations can contain a 56ms 20Mbytes disk, or even no hard disk at all. To my mind, it is pointless to run a fast processor with a low hard disk, and so the 30Mbytes voice coil would be the one to go for. The disk itself is a full height Seagate manufactured in Singapore, and would seem to have some sort of automatic head parking system which operates even in a power failure.

The disk controller card is a delightfully well designed board. Good use of VLSI technology makes for an exceptionally neat and clean appearance, with no loose leads and totally uncrowded. The controller can support two floppies and two hard disks, and since extra connectors and power feeds are included, expansion up to the full complement of drives would be a breeze. The controller card is manufactured by Western Digital, a respected name in disk controller chips and, incidentally, an American corporation.

An I/O card provides the serial and parallel interfaces for communications and access to the printer. This card is also a very neat affair, being only a half size board. Although the card is adorned with Wells American stickers, it is actually manufactured in Taiwan, ROC.

The display adaptor provided for review was a Hercules compatible monochrome graphics card. Now, I'm not much of a believer in Hercules graphics

cards, and a downright heretic when it comes to the non-Hercules compatible Hercules cards which seem to have found their way into many hapless machines. However, the Hercules compatible card in the A*Star II is, at least, actually compatible with the true Hercules card. The purchase price of the machine includes your choice of the Hercules card or colour graphics card. Alternatively, you may opt for the EGA compatible display adaptor, although this and the monitor required for it would greatly add to the price.

Incidentally, the display adaptor is also manufactured in the Republic of China. I guess a couple of foreign boards and disk drives do not detract too much from Wells' all-American claim. Although there were no visible identifying marks on the motherboard, one must assume that it was built in the USA.

The purchase price does not include a monitor, and a wide variety are available including Taxan, Sakata, TVM and Roland. The monitor provided for review was a monochrome Taxan KX-12, which is an adequate and reliable unit. It's hard to find anything exciting about most monitors. The important thing is that the monitor is well matched to the display adaptor card, and does full justice to the capabilities of the adaptor.

The keyboard is 100 per cent identical to the IBM PC/AT keyboard, even down to the right shift key being slightly larger than the left one. All the symbology on the keys are identical, as is the placement of the toggle indicators. Everyone has different tastes in keyboards, and many of the boards around these days tend to rattle a little and be a bit clunky. This keyboard, however, I really liked. It feels fast, and matches the pace of the machine most admirably. It has a firm feel to it, positive tactile feedback (but not to excess), and the keys seem to almost bounce back. I don't really know how to describe it, except to say that the keyboard completes this machines feeling of speed and performance.

In fact, the speed took a little getting used to. The machine almost seems to respond before pressing enter. If asked to execute a command, it's done it before you've managed to collect your thoughts on what you want to do next. I almost felt that I was letting the machine down by pausing to think, that I had some sort of obligation not to waste all that performance on merely scanning the keyboard.

Once you get used to it, this performance is an amazing aid to productivity. A large assembly language program which, on my Olivetti M24 (and it's no slouch), assembles in the time it takes to get a cup of coffee; on the A*Star II, it

assembles and links in the time it takes to steal a gulp of coffee.

System software

The A*Star II runs IBM PC-DOS 3.1. There is nothing shifty about this, as anyone can walk into IBM and buy a copy of DOS, in the same way that Amdahl and NatSemi mainframes run IBM proprietary operating systems. It is a little unusual, however, since most compatible manufacturers enter into an OEM agreement with Microsoft and supply a 'Brand XYZ' MS-DOS.

In hindsight, it is an obvious and smart move. It eliminates the hassle of an OEM agreement and all that goes with it. But more importantly, it must go a long way toward putting peoples minds to rest on the issue of compatibility. The benefit is perceived rather real, as most machines delivered with an OEM MS-DOS will also happily run IBM PC-DOS, and the compatibility problems between PC-DOS and MS-DOS are few. However, for the nervous buyer, the fact that the A*Star II runs IBM PC-DOS must be a reassuring consideration.

A Basic interpreter does not come as standard with the machine, but can be ordered if required. No interpreter was provided for review, but I would hazard a guess that the Basic would be Microsoft GW Basic rather than the IBM Basica. This matters not at all.

The only unusual utility provided is the speed selector, which can vary the processor speed from 6 to 12MHz with or without wait states.

The ROM Bios also contains a power-on self test (POST) which, happily, isn't one that takes a couple of minutes to go through its tricks.

The only disparaging remark which can be made about the entire machine relates to the Bios. When a given CPU speed is selected, the machine utters a series of beeps of varying tones which corresponds to the speed activated. For example, on 6MHz with one wait state, a single low pitch tone is emitted. As

Benchmarks

BM1	0.2
BM2	0.8
BM3	2.1
BM4	2.1
BM5	2.4
BM6	4.0
BM7	6.2
BM8	6.3
Average	3.0

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

USER SUPPORTED SOFTWARE**PC-SIG**

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PC-SIG is the world's largest distributor of User Supported software with a library containing over 600 disks. Anybody can purchase diskettes for just \$13 each or join as a member. A membership includes a listing of the library on diskettes or in book form, regular newsletters, and discounts on bulk purchases. The following is a small selection from the library...

Disk No 5 PC-FILE III V4.0

One of the widest employed user-supported programs, PC-File III is a general purpose menu-driven database manager. Designed for business, professional and home users, it allows you to retrieve data, change it, resequence it and perform queries quickly. It also prepares reports for display, printing or subsequent retrieval by your word processor, all through menus. Reports can be generated in many different layouts.

Disk No 10 CHASM V2.13

This full-featured assembler is ideal for learning assembly language and powerful enough for production coding.

Disk No 78 PC-WRITE V2.6/5

This powerful word processor supports most printers and incorporates 46 printer control files. Notable features include nine help screens, fast edit and save functions, split-screen editing and user configuration of keyboard, display and printer.

Disk No 184 DISKETTE UTILITIES V1.1

The utilities on this disk are grouped into three distinct categories. In the first category, COVER makes a disk-sized directory for easy storage. The second category contains a variety of utilities dealing with functions as diverse as altering file attributes and the creation of RAM disks. The third category has a wide range of unprotected utilities to help make backup copies or transfer copy-protected programs to a hard disk.

Disk No 199 PC-CALC V3.0

This spreadsheet program comes with a tutorial and many advanced features. Math functions include natural logs, power of x, averages and tangents. There are 26 columns by 255 lines with 64 characters per cell. It supplies numeric precision to 14 decimals and flexible print options with onscreen prompts.

Disk No 254 PC-DOS HELP V1.1

These programs offer on-line help capability for DOS commands. Type HELP for a master list of DOS functions. This disk is especially convenient for hard disks where it can be called on at any time.

Disk No 273 BEST UTILITIES V1.0

This is a compilation of the better utilities from the PC-SIG library. Most of the programs require DOS 2.0 or above.

Disk No 274 BEST GAMES V1.0

This is a compilation of the better games from the PC-SIG library.

Disk No 293 ARCADE GAMES V1.0

An assortment of colourful arcade games that will catch and hold the attention of game fans for hours.

Disk No 310 QMODEM V2.0e

This telecommunications program supports, among others, Hayes and Racal Vadic modems. It runs up to 9600 baud and features windowing, screen colour definition XModem protocol, autodial/ redial.

Disk No 344 & 345 PC-KEY DRAW V1.0

This disk is composed of programs offering keyboard to screen drawing, graphics printing, and slide show capability. Built-in technical functions allow it to be used as a CAD system. It requires colour graphics.

Disk No 376 PATCHES V1.0

The programs on this disk allow the placement of specifically indicated programs on hard disks and the creation of backup copies.

Disk No 403 PC-TUTOR V4.2

This disk contains tutorials that cover the basics of a first course in computer usage and the IBM PC disk operating system. It also has a program that reads coded text files.

Disk No 405 PC-DESKMATES V1.1

The memory-resident accessory program can be called from any program or from DOS. It includes alarm clock, calculator, calendar, selected DOS commands, notepad, phone dialer, printer control and typewriter.

Disk No 480 PC-OUTLINE V1.04

PC-OUTLINE is comparable to ThinkTank. Users can outline and organise items by arranging and rearranging them using different classifications.

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higher speeds are selected, the tone gets higher in pitch and is combined with other tones. A nice idea, and a relatively harmless one. However, the machine utters the same sounds when it reboots, and the signature of the top speed is a three tone sequence which bears an unfortunate resemblance to a space invader going down the gurgler. If one is involved with the sort of work which requires regular reboots, and if the reboots generally correspond to some neat idea going down the gurgler, this sound can become quite abrasive. On the other hand, if you tend to turn the machine on in the morning and never have to reboot during the day, this sonic pollution should pose no aggravation.

Compatibility

Being an AT-compatible, and a highly compatible one at that, the A*Star II needs no specialised source of application software. Running IBM PC-DOS makes the machine just that little bit more compatible and so prospective owners should have no problems drawing from the bottomless pit of IBM software.

Documentation

As the review machine was the first A*Star II to hit Australia, very little documentation could be provided.

The DOS manual will be the standard IBM PC-DOS documentation delivered by IBM, and as such, cannot be complained about. Similarly, the Basic manual will be either the standard IBM or Microsoft.

In fact, the only documentation specific to the A*Star II is the hardware User's Guide. This 23 page document

describes unpacking, installation, options, software installation and what to do in case of difficulties. The manual includes lots of good diagrams and is well written in 'American', which makes a nice change from 'Chinglish'. Considering the size of the manual, it actually manages to cover quite a lot of ground and does it in a clear and readable manner.

Delightfully, free schematics are offered to anyone who chooses to return a coupon included in the box. This is absolutely terrific. Some manufacturers simply refuse to let schematics go out the door, others such as IBM and Olivetti include them in rather expensive hardware reference manuals. While not everybody can make use of schematic diagrams, those who can find them indispensable for hardware maintenance and even software development.

Prices

A fully configured A*Star II with 30Mbytes fast hard disk, 1Mbyte RAM, ports, display adaptor, keyboard and 12MHz CPU costs \$7590, excluding monitor. Dropping down to a 8MHz CPU (as if anyone would), reduces the price to \$6690. Replacing the hard disk with a

slower 20Mbytes model, still with the slower processor, lowers the price to \$5665. Finally, with the slow processor and no hard disk at all, the A*Star II costs just \$4500. The cost of the monitor will depend upon the display adaptor you have chosen, but at the low end will be a couple of hundred dollars.

KCM, the importer of the A*Star II, is running a special introductory offer which may or may not still be available at this time. The offer reduces the price of the top configuration to \$6360.

Conclusion

Probably the highest praise any product can receive is whether or not the reviewer wanted to keep it, or was glad to see it go out the door.

This was one product I most definitely wanted to keep, and would even strongly consider purchasing. It offers the attribute which AT machines are all about — *speed*, and manages to capture the essence of it and project it upon the user. Added to this, the machine is well designed and constructed, fights back against Taiwan becoming the PC capital of the world, and is available at very attractive prices.

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Processor:	80286 running at 6, 8, 10 or 12MHz
RAM:	1Mbyte on motherboard, expandable to 16Mbytes
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Display:	MDA, CGA, EGA or Hercules compatible adaptors
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Compaq Desk Pro 386

Any poseur knows it's infinitely preferable to be seen driving around in a Ferrari rather than the ubiquitous Camira, even if its ability to get from A to B any quicker on today's cluttered roads is highly questionable. Speed has long been a course of fascination and it is on this count that Compaq is hoping to appeal with the Deskpro 386.

This is simply *the* micro to be seen with. It uses the very latest microprocessor (the Intel 80386 running at 16MHz) which uses 32-bit architecture. This offers considerably more performance than can yet be put to use. The DeskPro 386 is ahead of its time; IBM is likely to launch a machine which uses the same microprocessor, but not for a while.

The Compaq 386 gives an immediate improvement in speed, yet it has the potential to allow things not possible on existing IBM-compatible computers. Unfortunately, as yet there is no software available to take advantage of this potential.

To all intents and purposes the DeskPro 386 is externally identical to the existing Compaq DeskPro 286. By current standards the case is large but compensates for this by having room for lots of options. The standard finish and construction is superb throughout the machine; which contrasts with imported Taiwanese clones and such like.

There are three models of the Compaq DeskPro 386. The Model 40 includes a 40Mbytes hard disk, 1.2Mbytes floppy disk and 1 Mbyte of RAM. The Model 70 is basically the same but a 70Mbytes hard disk. The Model 130's only difference is a 130Mbytes hard disk. All machines have RS232, Centronics port and a real-time clock.

Hardware

Taking the covers off the 386 reveals the heart of this new unit, the Intel 80386 microprocessor (called the 386 for short). Technical buffs may be interested

to know that the 80386 processor looks rather different to the now widespread 8088/8086 type of microprocessor. The mass of pins, 152 in fact, are necessary to allow use of its 32-bit architecture. The chip sits next to the RAM board slot and near a normally

empty conventional chip socket designed for the 80287 maths co-processor.

The 80386 chip runs at a clock speed of 16MHz, which makes it twice as fast as IBM's fastest micro, the IBM PC/AT. This gives an immediate doubling of



speed with all IBM software. But the 80386 chip has the potential to be several times faster still with software specially written to use its 32-bit instruction set.

Unfortunately 32-bit architecture demands memory to be arranged in a special way to ensure that memory access speeds match the rest of the system. To this end Compaq has included a high-speed memory board which can accept up to 2Mbytes of 32-bit memory. If more than 2Mbytes of memory is to be fitted, the more conventional and slower memory expansion boards have to be used. With these, the machine allows up to 16Mbytes of memory to be fitted. When 1Mbyte chips become freely available this upper limit will be lifted.

This extra memory is all very well, but current versions of MS-DOS can only use a measly 640k. To get around this, Compaq has included something called CEMM with the DeskPro 386. This is short for Compaq Extended Memory Manager and allows suitable applications packages to use memory above 1Mbyte for data, thus allowing for example, larger spreadsheets to be manipulated.

The extra memory can be used by programs which use the Lotus-Intel-Microsoft specification for extra memory. Several well-known programs (including Lotus 1-2-3 version 2) can make use of this extra memory, but many others cannot.

As with previous DeskPro models, the expansion potential is good. The full-specification machine tested had three vacant 16-bit slots and two empty 8-bit slots (although one of the latter was only able to accommodate a one-third length card).

The machine tested was fitted with Compaq's own Enhanced Graphics Adaptor, which is compatible with IBM's EGA. This includes 256k of dedicated display memory and allows 16 colours (from a palette of 64) to be shown. The graphic resolution in enhanced mode is 640x350 pixels and it can also display high-quality text. A cheaper option is the Compaq Video Display Controller Board and monochrome monitor as fitted to

lesser models in the range.

Neither display board nor monitor is included in the standard system price. Nor is the operating system.

Most people are likely to choose other options which will add to the cost of the machine. Backing-up the hard disk is especially important with large-capacity units and so the optional 40Mbytes tape unit seems like a good idea. The DeskPro has room for no fewer than four half-height storage devices so if the tape unit is not required an additional 40Mbytes hard disk can be fitted.

As standard, the DeskPro 386 is supplied with Compaq's new enhanced PC/AT keyboard. This is an interesting unit produced in answer to similar offerings from IBM. The concept behind the enhanced unit is to do away with all the dual-action keys that abound on the standard keyboard, which can be infuriating.

There is a separate set of cursor controls beneath a pad consisting of the Insert, Delete, Home, End, Page up and Page down keys. There are 12 function keys, two ctrl keys and two alt keys. A pair of equal-sized shift keys are placed symmetrically at either side of the keypad. The only real problem is the rather small return key: a definite backward step compared to the far better shaped key of the standard PC/AT unit.

As with other Compaq keyboards, the key action is a matter of personal taste; people either love it or hate it. It is undoubtedly stodgy but it could be argued that this makes it gentle on the finger tips.

System software

For single-user applications the DeskPro will (for the moment at least) be tied to MS-DOS version 3.1 which is an adequate operating system for such a powerful microprocessor. Its limit of 640k of standard memory makes a nonsense of the huge amounts of memory the 386 can use. It does, however, provide compatibility with all existing PC applications software and keeps the machine's options open for the future.

There are other ways of making those

32-bits work for a living and that is by sharing the microprocessor's immense power between several users, either in a network or a multi-user set-up. The DeskPro's high-speed microprocessor and its huge and fast hard disk make it an excellent 'file server' at the heart of a network of micros.

The multi-user approach of attaching cheap terminals to the main unit via RS232 interfaces is also worthy of mention. At present this uses the Xenix 286 operating system which can realistically support up to a maximum of eight users on an IBM PC/AT. The more powerful Compaq 386 should offer a substantial improvement here. For the future, a new version, Xenix V/386 is under development using full 32-bit instruction code and this will increase its power still further. Xenix V/386 is due to arrive next year.

The snag with Xenix is that users cannot run their standard PC software, but this may also be put right in the future.

Finally, Digital Research (the originator of the famous CP/M operating system) is believed to be developing an operating system to make full use of the 386 microprocessor.

Compatibility

Compaq has always set the standard others try to achieve when it comes to compatibility. So far the company has had little trouble maintaining the lead but it must have had its work cut out with the DeskPro 386. Its 32-bit architecture and 16MHz clock speed will all have conspired to produce compatibility problems.

Most software tested ran without any problems, however, compatibility did not seem quite as good as with its more mundane stablemates. There could be several reasons for the occasional problem that occurred. The EGA display system can reject certain packages and the 1.2Mbytes drive can also cause problems. Maybe we have come to expect too much of Compaq, especially bearing in mind that the 80386 processor is so different from the 8088 used in the original IBM PC. The DeskPro 386 still displays excellent compatibility

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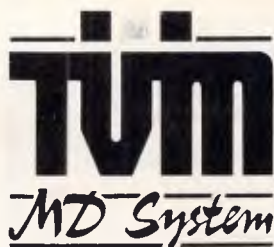
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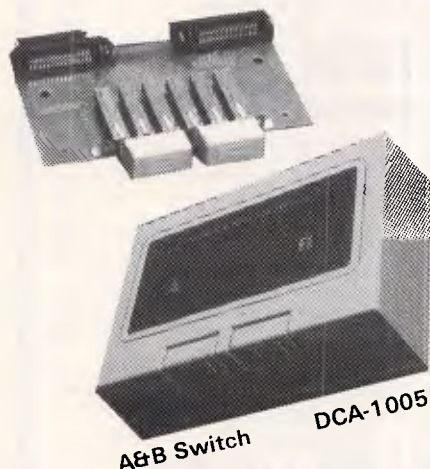


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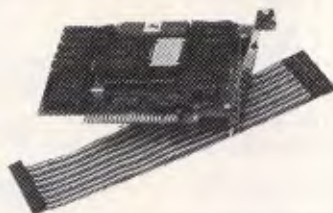
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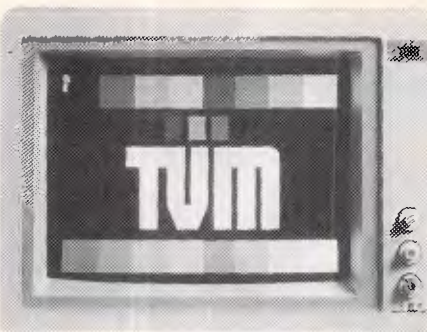


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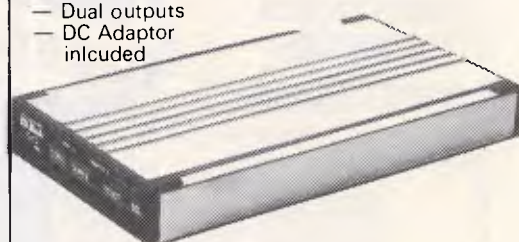


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with off-the-shelf IBM PC software. Any minor problems will probably be sorted out between Compaq and the relevant software house before too long.

Documentation

Unfortunately, no manuals were available from Compaq in time for this review. If past performances are anything to go by, the final documentation will be well presented and comprehensive — well up to Compaq's usual high standard.

Like most large companies, Compaq does not sell to customers directly but has a respectable and trained dealer network to sell its products to customers and give them continuing help.

Compaq is notable for having a relatively small number of dealers but they are of high quality. This means they should be able to provide the help and support needed with a machine as advanced as the Compaq DeskPro 386.

Prices

The cheapest DeskPro 386 system is the Model 40 and costs \$14,250 which includes a 40Mbytes hard disk, 1Mbyte RAM, one 1.2Mbytes floppy disk, an AT style keyboard, serial and parallel ports and a real-time clock.

For \$16,050 you can purchase the Model 70 which includes the same basic system, but exchanges the 40Mbytes hard disk for a 70Mbytes hard disk.

The Model 130 has a 130Mbytes hard disk and the same basic system and the price is \$18,950.

Options for the DeskPro include a 40Mbytes tape streamer \$1706; colour monitor \$1397; EGA board \$1397; 360k floppy drive \$503; four to eight megabyte 32-bit RAM expansion board \$7070; MS-DOS version 3.1 \$205; and the Xenix base system (up to 16 users) \$1478.

Benchmarks

BM1	0.1
BM2	0.5
BM3	1.4
BM4	1.4
BM5	1.5
BM6	2.6
BM7	4.0
BM8	4.6
Average	2.0

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 80386 running at 16MHz
RAM:	1Mbyte, expandable to 10Mbytes in one slot
ROM:	128k
Keyboard:	IBM PC/AT style 85 key; Enhanced 101 keyboard
Display:	Compaq dual-mode monochrome monitor in green or amber, EGA colour monitor and display card, resolution 720x350 in 16 colours
Weight:	N/A
I/O:	Centronics parallel port, 25-pin IBM PC connector; RS232 serial port, nine pin D-type connector
Mass Storage:	Half-height 1.2Mbytes 5.25in floppy drive; half height 40Mbytes hard disk
DOS:	MS-DOS 3.1, with Compaq Bios and CEMM memory manager; Xenix System V/286

Conclusion

The DeskPro 386 is the first IBM-compatible to use the high-powered 80386 microprocessor. Like all Compaq machines it is beautifully engineered and professionally supported. It is also the most powerful PC-compatible currently available. For the moment, at least, its use is a case of overkill in the vast

majority of single-user applications. The exceptions to this are spreadsheets, large databases and the like.

The speed gain of the DeskPro 386 is an immediate and noticeable benefit, but in the long run the possibilities of new operating systems may prove more significant. These will allow several programs to be run at once and several people to use the same computer.



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NEC APC IV

When NEC announced its APC III, it was basically incompatible with the IBM PC. But the APC IV starts from where the APC III should have started from — compatibility. This time, it's too late for PC-compatibility to be enough, and the APC IV is an AT-compatible. Not a bad one, either.

The APC IV is a large machine at 54cm x 16cm x 42cm. The colour scheme of the machine is similar to the APC III — grey and cream — and it looks fairly impressive. There are four cut-outs on the front and the machine can handle up to two floppies, up to two hard disks, and an optional tape backup drive. The review machine was supplied with one 40Mbytes hard disk and a 1.2Mbytes floppy drive.

Hardware

On the front panel is the only thing that allows the initiated to tell a PC-compatible from an AT-compatible — a key-operated switch with the legend Lock/Unlock/Reset on it. The idea is that when you want to protect what's on the disk, you turn the key to Lock, and this makes the keyboard go completely dead.

The Reset position of the switch (and it was a good idea making it key accessible only) is the equivalent of the reset button on other machines, and of the ctrl-alt-del key combination on the PC and AT. The difference is that the switch is a proper *hardware* reset, which will restart the machine and get you out of trouble even when the thing is so confused that it doesn't recognise a ctrl-alt-del.

Next to the keyswitch is a pair of lights, which glow when the power is on, and when the disk is being accessed. Then come the four disk/tape cut-outs — that 40Mbytes hard disk takes up only as much room as a standard-height floppy drive.

At the base of the front panel, tucked out of sight under a ledge, is a switch labelled '6/8'. This gives you the choice of running the 80286 processor at either 6MHz or 8MHz.

Naturally, 8MHz makes processing faster. The reason for giving you the choice at all is that some software will not work properly at 8MHz, so there has to be an easy way to change when you go from one piece of software to another.

I found out entirely by accident, by the way, that you have to reset the machine every time you change the position of the 6/8 switch. When you toggle it the machine hangs — which I suspect is something actually designed into the system.

The power switch is in the standard IBM position, round the right-hand side of the case. That puts it far enough away to stop you hitting it with your coffee cup handle, but near enough so you don't have to be double-jointed to reach it without getting to your feet.

The keyboard complies to the standard IBM AT layout, and includes indicators for the toggle keys in the normal AT position.

On the whole, I liked the APC III keyboard (it was about the only thing I liked about that machine, in fact), and I like the APC IV keyboard even more.

The keys have a nice 'touch', and the usual pop-up feet make the whole thing quite comfortable to use. It's also light, and has a nice long lead on it for people who, like me, can't afford adjustable computer desks and like to use the keyboard on their laps.

Round the back of the unit there are the usual confusing selection of sockets. Why is it that one of the prerequisites for

an IBM PC or AT-compatible is that most of the sockets must be unlabelled?

The mains input socket is next to a mains output socket — useful for the monitor, of course. There's a switch to select 110V or 240V, for those of you who run 110V sites in Australia. The monitor supplied with the review machine was 110V only and had its own external transformer, which is an indication of just how new this machine is in this country.

In the middle of the cabinet are the sockets for two serial communications/printer ports (actually labelled, which is a nice surprise) and a parallel printer port, which are standard for all configurations of the APC IV and which are claimed to be totally AT-compatible. There's a standard DIN socket for connection of the keyboard, and then cut-outs for each of the eight expansion slots.

On the review machine, one of the slots was taken up by a video card, and so had one IBM-standard RGB video output and two other phono sockets, at least one of which was presumably for composite video.

The card supplied with the review machine was IBM EGA (Enhanced Graphics Adaptor) compatible. NEC has another version which is compatible with



AT-COMPATIBLES

the less powerful CGA, and a third — compatible with the top-of-the-line PGA.

The monitor supplied with the review machine was an APC-H431 Advanced Colour Monitor, which has a 35cm screen with a resolution of 800x400. Unusual for a monitor, there are actually a few controls to play with.

On the top of the monitor there is a little trapdoor, which opens to reveal controls for not only brightness and contrast, but also vertical hold, vertical size and vertical position, and horizontal position.

Also inside the trapdoor there are a couple of switches. The first changes the horizontal size by about 5 per cent, and the other switches from normal to a special Text mode.

Text mode simply makes the monitor monochrome. But unlike other monitors, it doesn't restrict your choice of colour to either white or green. There is a set of dip switches round the back of the monitor that allow you to alter what colour of monochrome you get.

The advantage of Text mode is that for an analogue input (of which more in a minute), the Text white will be a whiter white than the non-Text white.

Round the back of the monitor there are even more switches. First, there's a power switch — it may be a small point, but the monitor I've got connected to my machine has the power switch in the brightness control, which means that if you actually want to use it as a power switch, you've got to change the brightness level from what you found after long hours was a good compromise.

Also on the back of the monitor is a TTL/ANALOG switch, which allows you to use the monitor with both types of RGB input.

If a choice of colour or monochrome weren't enough, two more sections of that dip switch allow you to choose eight, 16 or 64 colours, and you can select either the setting you choose on the dip switch, or the normal setting for the monitor by switching yet another switch called Manual.

I counted 10 switches and six control knobs on this monitor — that's *got* to be a record. It even has three indicators to

indicate whether you are in Text and Manual modes, and whether the power is on. And the indicators are on the top of the monitor, instead of being on the front, where they annoy the operator.

The only thing I could think of that this little beast didn't have was a composite video input. And the quality of the output? Excellent. It's nice and stable, too.

The monitor comes with a standard tilt and swivel stand, and all in all it's the best monitor I've seen in a long time.

Meanwhile, back at the APC IV itself ... taking the top off is simply a matter of removing some screws at the back and lifting the cover. That's much better arrangement than some machines (such as the IBM PC), where you have to slide a metal sleeve off the machine, but it's not as good as some PC clones, which have a sort of 'car bonnet' arrangement which sits up while you poke about in the machine.

Anyway, the inside of the APC IV looks good. There are eight slots (two short and six long), which NEC assures me are completely AT-compatible.

In the review model, one of the slots was taken up with the EGA-compatible colour board (made by NEC), another looked like a memory board, and the third was the disk controller card.

The EGA colour board still had the odd wire link on it — a sure sign that this was one of the first few boards off the assembly line. (This is quite normal in review machines, and the wire links usually disappear by the time the machine hits the dealers). It had lots of dip switches, wire links, extra board sockets and what looked like a plug-in ROM chip, all of which make me suspect that it's a very flexible box.

The 'memory' board was not fully populated (ie, there were sockets on the board which had no ICs in them). What surprised me most about the motherboard was the fact that there was so little on it. The chip count looks very low for an AT.

There are six sockets that look like they hold the system ROMs — two of them were taken up with UVEPROMs (which may be replaced with ROMs in the final versions) from what looked like Phoenix. (When I turned the power on later, the

sign-on confirmed this). Phoenix ROMs are more or less completely compatible with the IBM original (but of course are not copyright IBM). Even where they are not compatible, they are so widely used that any clever software developer will avoid the non-compatible areas, so that anything with a Phoenix ROM is a pretty safe bet.

Also on the motherboard of course was an 80286-8, the 8MHz version of the AT processor. There were also a few more dip switches (generally a good sign), and an empty IC socket which was presumably for the 80287 maths co-processor.

A rechargeable battery pack for the internal clock was held onto the back panel by a pad of velcro.

There really are four spaces for disk drives in the box, and one floppy and one hard disk drive were fitted. The hard disk (which makes the strangest hard disk noise I've heard so far — not loud, or even annoying — but strange) is made by NEC, and holds 40Mbytes. The floppy (also by NEC) holds 1.2Mbytes.

NEC tells me that the APC IV can handle two of those 40Mbytes drives, giving a total of 80Mbytes: that would be respectable for a small mini.

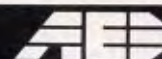
All in all, the inside of the APC IV is neat and well-engineered. A fair amount of thought has gone into it. It even looks like it might be quite simple (although I admit I didn't try it) to operate the machine with the front panel off. This might not seem like a tremendous advantage, but when you're troubleshooting a faulty disk drive, believe me it is. The bottom line for a user is that when your machines goes down, it will take less time to fix.

System software

When I powered up the APC IV, I got the Phoenix 80286 ROM sign-on, followed by a quick message check that told me that there was 640k of memory installed, and 1024k of expansion memory. The documentation points out that this is not actually 'expansion' memory at all, but 'extension' memory.

The upshot of all this is that the APC IV can have up to 2Mbytes of RAM added

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to it, on top of the maximum 640k that can be supported by MS-DOS. The extra RAM can be used for things like virtual disks, and it can be accessed by Pick and Xenix. Products such as Symphony can also use it, as it conforms to the Intel standard for expanded/extended memory.

The machine came with MS-DOS 3.1 and version 3.1 of Command. Because of the differences in ROM, the APC IV wouldn't run my version of BasicA for the Benchmarks (many compatibles won't), but another version (copyright Matsushita, strangely enough) was supplied with the review machine, and I ran the Benchmarks with that instead.

Compatibility

The APC seemed to be able to run any software I tried it with, and the review machine was supplied with AutoCad (which not only ran, but ran nice and fast).

There are a number of minor software problems noted in the pre-release version of the documentation which came with the review machine. I assume that they will all be fixed before the machine is sold to the general public. In any case, the only really bad one was the lack of a sensible return to a Bios INT 13H (return drive parameters), which is unlikely to cause any major problems.

There is also a small problem with the VDISK virtual disk utility supplied with the APC IV, when the virtual disk is set up in extended memory. Essentially, it will cause the machine to ignore interrupts while the virtual disk is being accessed. To get around this, there is a parameter which limits the number of 'sectors' that are transferred to or from the virtual disk at any one time. The idea is that if it transfers only one at a time, say, it will be looking for interrupts at the end of each 'sector'. This will probably only be a problem with things like communications software, and the manual gives a couple of fixes that might work.

As with the APC III, the DOS utilities

supplied with the APC IV are a mixture of standard MS-DOS ones and variants written by NEC.

Of particular interest are the following:

XASSIGN which allows you to route all calls from one drive to another and also lets you redirect all calls for a particular file name to a different path and/or drive.

CHMOD allows you to see and alter the attributes to any file. The MS-DOS utility closest to CHMOD is ATTRIB, which only allows you to make files read-only.

CRTDUMP allows you to dump the current screen contents (graphics and all) to an NEC printer. Colour screens can also be dumped to NEC colour printers.

SIZE totals the number of bytes for any set of files — particularly useful if you want to know whether they are going to fit onto one disk or not.

XTREE does the same as the MS-DOS TREE, except that it only shows you what's in or under the current directory.

The speed of operation of the APC IV can only be described as 'blinding'. The Benchmarks below were done with the front panel switch at the 8MHz position — as a comparison, they are roughly twice as fast as the APC III. I repeated BM8 with the switch set to 6MHz, and got the expected 25 per cent reduction in speed, with a timing of 13 seconds.

Documentation

The only major criticism I have of the APC IV is the documentation, and it's something that could be easily fixed. Now, the documentation set I got with the review model was a pre-release version, and if NEC intends to fix this problem before it releases the first machines, well and good; but it had exactly the same problem with the APC III documentation and it didn't bother to fix *that*.

The problem is this: NEC has supplied a copy of the original MS-DOS manual, with all of the utilities described as they were supplied by Microsoft. Then, in a

separate section, they have told the reader what the difference is between the Microsoft and NEC versions. That means that if you are looking at the MS-DOS version of a command, there is nothing to show you that the version which is actually running on the machine may be different. The solution would be to interleave the MS-DOS and NEC commands, replacing the MS-DOS ones with the NEC ones where necessary. It doesn't look difficult to me, and it would make the manual a lot more readable.

Having said that, the documentation is not all that bad.

Prices

The APC IV is sold in three configurations. The entry-level one (called the APC IV-EL) has the unit itself, an Advanced Colour Monitor (same as the one on review), a 40Mbytes hard disk, a 1.2Mbytes floppy, 640k of RAM and a CGA-compatible video card, and has a recommended retail of \$9935.

The APC IV-AG is the same as the base, but with an EGA-compatible video card, and it has a rrp of \$10,448.

The third configuration, has a PGA-compatible card and a new monitor called the Power Graphics Monitor (with a resolution of 1120x750 and a 35cm screen), and that will have an rrp of \$12,244.

An expansion RAM card with 512k fitted costs \$593, and you can add up to three RAM chip sets to that for \$296 each. A 360k floppy costs \$450 and a second 40Mbytes hard disk is \$2685.

Conclusion

The APC IV is what the APC III should have been — compatible, solid and fast. It's exactly the sort of machine that companies like Sperry, ITT and NCR have been producing. It doesn't try to go out on a limb (like the APC III did), but concentrates on being a workhorse which can run standard applications very quickly.

Benchmarks

BM1	0.5
BM2	1.5
BM3	3.0
BM4	3.0
BM5	3.0
BM6	6.0
BM7	9.5
BM8	9.5
Average	4.5

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	80286, 8MHz (6MHz switchable)
RAM:	640k standard, expansion memory up to a further 2Mbytes
ROM:	64k
Keyboard:	IBM PC-style
Display:	CGA, EGA, PGA
Weight:	20kg
I/O:	2 serial, 1 parallel ports standard
Mass Storage:	1.2Mbytes disk drive, 360k disk drive, 40Mbytes hard disk
DOS:	MS-DOS, modified by NEC

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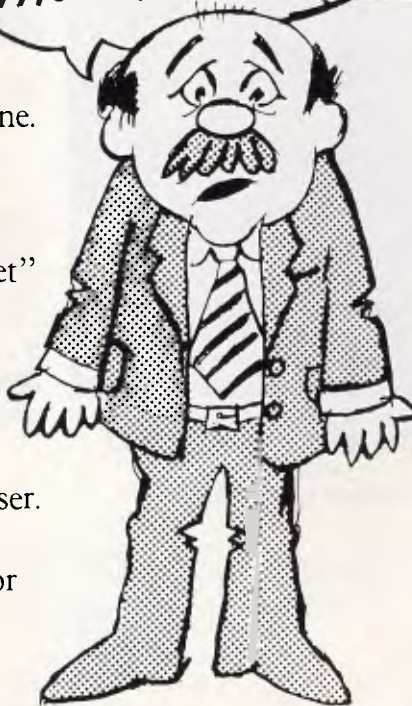
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Televideo 286

Televideo, with a long history in intelligent terminals and guided missiles, has entered the AT stakes with its latest machine, the Telecat 286.

Like much of the Televideo equipment, the machine shows originality in design, and exhibits many departures from the standard AT packaging and internal layout, resulting in a machine which is distinctive, attractive and can offer many advantages which the more mindless clones simply cannot.

Hardware

The single most noticeable feature of the Telecat is its physical departure from the AT style. The machine has an incredibly small footprint, being about the same size as an Olivetti M24. This makes the unit small by PC standards, and positively tiny by AT standards. Footprint size is an important consideration.

By almost halving the desk space requirements, Televideo succeed in creating an attraction which few other machines can offer. As time progresses, more and more buyers are considering physical bulk to be near the top of the list influencing purchase decisions.

When ATs were initially introduced, there seemed to be a conscious marketing strategy to make the machines larger so that the higher price tag appeared more justified, which resulting in vast empty spaces inside most AT cases. The informed buyer does not think that you get more computer if it comes in a bigger case, and so Televideo's effort for compactness should be greatly appreciated by most.

The screen is a large, flat job with a tilt swivel base. It sits on top of the system unit at close to eye level and can be easily adjusted to suit the operator. The screen is not the traditional monolithic blob pioneered by IBM and faithfully reproduced by everybody else, rather its contours follow the dimensions of the CRT within. The end result appears elegant and different.

The entire flavor of the Telecat reeks of the same design decisions which influenced the Olivetti M24. The unit is neat, stylish, compact, high performance, extremely compatible and includes all the important features as standard equipment. These attributes worked well for the M24, and it would come as no surprise if the Telecat becomes to the AT market

what the M24 was to the PC market.

Lifting the cover reveals quality precision engineering packed quite tightly into the chassis. The power supply is of the sealed metal box type, somewhat larger than most and can be switched between 110 and 240 volts. The fan is included in the power unit and the switch is positioned on the rear of the case, a few inches from the right hand side. This is a departure from the IBM standard, but does not involve the full scale search procedure required on some other machines who have opted for similar placements.

Significantly, an externally accessible fuse is provided. Many sealed power units include the fuse within the sealed box, which is of very little use. Making the fuse externally accessible means fewer maintenance calls for failed power supplies. The unit is rated at 140 watts which, although significantly less than many AT machines, is no doubt enough for expansion.

The only area in which the Telecat's features are compromised by its size is in the area of expansion ports. The machine only provides five of these, four being 16-bit ports, with the other being an 8-bit port. However, this may not be a serious limitation as the Telecat includes many features on the motherboard which on other machines would have to be im-

plemented on expansion cards. Two of the ports are initially filled, one with the display adaptor card and the other with the disk controller card. This leaves three ports free.

The motherboard makes relatively little use of VLSI chips, and positions the memory chips in the bottom right hand corner of the board, situated under the disk drive. This is also a departure from the conventions among ATs, which tend to place the memory on the bottom left hand corner. It really doesn't matter where the memory goes, but it does serve to illustrate that Televideo has done some pretty serious re-thinking about the AT design. The traditional 80287 numeric coprocessor and expansion ROM sockets are included.

In a nice touch, a bracket on the front of the chassis may be removed for removal of the motherboard. Most other machines require that the entire machine is virtually stripped bare before the motherboard can be removed. Using the Telecat approach, a technician need only unplug the expansion cards, remove the screws, and slide the board through the forward access port.

The floppy disk drive is a half height and provides a capacity of 1.2Mbytes. A bracket over the drive protects it during cover removal, as well as assisting cover



AT-COMPATIBLES

replacement. This can be compared to another AT in which replacing the cover pulls a connector out of the disk drive. Space for a second floppy drive is provided underneath the first.

The hard disk is a SysQuest 20Mbytes device mounted vertically next to the floppy assembly. This move saves a good four inches in machine width while also preserving expandability. Additionally, when you pause to think about it, vertical mounting may also enhance reliability of the drive, as most shocks are in the vertical dimension (dropping, etc) and shocks with that orientation will not smack the disk head against the disk surface. The drive is only an 85ms access speed device with stepper motor, which is more than twice as slow as many AT machines, but Televideo claim that the disk controller compensates for this limitation. More on this later, but certainly Televideo's claim appears to be true. Strangely, no disk access light is provided.

The display adaptor card is quite a novel piece of work. It was specially designed by Televideo, and tries to pull off the same trick found in the Olivetti M24 and several other machines. Although the card is compatible with the IBM colour graphics adaptor (CGA), it nevertheless manages to provide a decent character font (8 x 16). The normal CGA provides very poorly formed characters (8 x 8) which quickly produces eye strain.

Of all the machines which try to work this CGA trick, only a few get it exactly right. The M24 was one of the first PCs, and the Telecat is one of the first AT machines to get it exactly right. This is a real asset, as it means that the machine is capable of graphics, but is also suitable for extensive text work. In addition to providing the standard CGA graphics modes, the adaptor can also perform 640 x 400 monochrome, 320 x 400 in four colours, and 640 x 400 16 colours, although this mode requires the addition of 96k RAM to the adaptor board.

The monitor, as mentioned, provides a tilt swivel base and has a diagonal width of 14 inches. A cable running to the system unit provides both the video signals plus the necessary power. The monitor is of stylish appearance and high quality performance. A single control adjusts brightness, and a long two metre cable means that the system unit can be positioned remotely from the screen. In normal usage, however, most users would be happy to situate the display on top of the system unit, as the footprint is sufficiently small. In other AT-compatibles, the ability to mount the system unit separately is a must, but very few allow sufficient cable length.

The keyboard conforms to the IBM 10 function key standard, with the exception

that the toggle indicator LEDs are situated on their respective keys, rather than being grouped in a separate panel. The board has a good feel to it. Everyone has different tastes in keyboards, but the disdain for a clunker is universal. This board is not a clunker, it has light tactile feedback and is stable to work with.

The disk controller can deal with two floppies and two hard disks, and makes use of a Western Digital FDC chip. The board is said to enhance the otherwise slow disk through the use of double buffering. All disk input/output read and write complete tracks, rather than just individual sectors. As most input/output come in groups and reference physically clustered sectors, this 'cache' means that a certain percentage of input/output requests may not have to access the disk, and that would certainly enhance speed. The degree to which an application benefits from this will depend greatly on the nature of the application and the degree of fragmentation on the disk.

The memory provided as standard is 512k which may be expanded to 1024k on the motherboard without the need for expansion boards. The processor is an 80286 running at 6 or 8MHz, switch selectable only through a small switch on the rear of the unit. I get the impression that Televideo do not expect people to actually change the processor speed, as the manual suggests that you refer to your dealer before doing so. They may well have a point. Slower speeds are only provided for compatibility with some highly dependent security systems, but now that higher processor speeds are so common, software vendors are making allowances.

Changing speed while the machine is running, which I presume you're not actually supposed to do, sometimes reboots the machine, sometimes hangs the machine until you reboot, and sometimes works fine.

Included as standard equipment are a parallel and serial port. Both are implemented on the motherboard thereby conserving a valuable expansion slot. Battery backup for the clock/calendar and CMOS RAM is provided by a large lithium

battery, and replacement of it would probably require some assistance from your dealer, as it's not the sort of battery you'll find in the corner shop.

The chassis is well constructed and everything fits where it's supposed to, and fits well. The chassis is more than just a shell, and gives the impression of quality and physical support.

In general, the hardware is innovative, compatible and of high quality. It is manufactured in Korea.

System software

The ROM Bios and power-on self test (POST) are implemented in 64k of ROM, although probably not all 64k is used. The bootstrap sequence is one of the fastest I've seen - no messing around, it just gets on with it and boots the machine.

The operating system is MS-DOS 3.1, sporting the Televideo OEM label. It is a completely standard MS-DOS, with no additional facilities added by Televideo, and therefore probably no messing around was done with its internals. OEMs that license MS-DOS from Microsoft are allowed to change the product in almost any way they like. For this reason, Microsoft say that there is no such thing as 'standard' MS-DOS, since most of the vendors have a chop at it on the way past. However, the less an OEM fiddles about with DOS, the closer it will be to mainstream MS-DOS and the less likely it

Benchmarks

MB1	0.5
BM2	1.8
BM3	4.2
BM4	4.3
BM5	4.7
BM6	8.2
BM7	12.9
BM8	13.0
Average	6.2

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

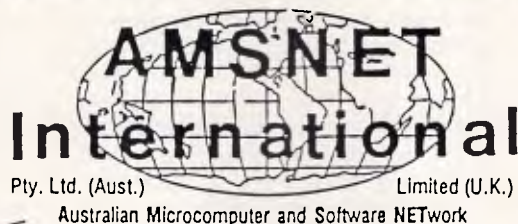
Technical specifications

Processor:	80286 running at 8MHz
RAM:	512k standard, expandable to 1024k on motherboard
ROM:	64k
Keyboard:	Standard AT layout
Display:	CGA compatible with additional 640 x 400 mono mode, and 640 x 400 in 16 colours after memory expansion
Weight:	N/A
Dimensions:	41.9 x 40.6 x 15.8cm
I/O:	Serial, parallel, five expansion ports
Mas storage:	1.2Mbytes floppy; 20Mbytes 85ms hard disk
DOS:	MS-DOS 3.1

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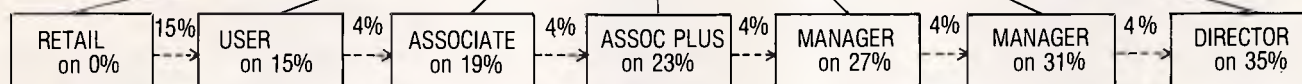
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AT-COMPATIBLES

will be that the vendor has introduced its own compatibility problems.

A basic interpreter is also provided - Microsoft GW Basic version 3.1. Televideo has enhanced the interpreter to support the high resolution graphics of which the Telecat is capable. Not all AT-compatibles are provided with Basic these days, but it is a very handy facility to have available, should you need it.

No doubt users could also run Xenix on the Telecat, if they so chose. However, Xenix is quite rare as most people find that the software availability under MS-DOS is too great an attraction to ignore.

Compatibility

The Telecat has a high degree of compatibility and can draw on the virtually limitless library of IBM PC software.

No applications software is bundled with the Telecat, which is an emerging trend.

Documentation

Three manuals are provided with the Telecat. The MS-DOS manual is the standard Microsoft work, with little adaptation by Televideo. As such, it is of identical quality to most of the other MS-DOS manuals being delivered with compatibles.

The GW Basic manual is also the standard Microsoft work, but with a number

of extensions where Televideo has enhanced the software to take advantage of the superior hardware. Both manuals are attractively boxed in ring binders.

The final manual covers installation and hardware usage. Each section is of about 100 pages and includes many useful diagrams. For most AT-compatibles, this is the only manual actually produced by the manufacturer, and tends to be the one of lowest quality and most prone to 'Chinglish'. The Telecat manual, however, is exceptionally well written. It guides the user well, and in many ways seems quite protective. For example, it recommends to park the hard disk whenever the system is turned off, and to never power on or off when a disk is in the drive. These recommendations are, if anything, overly cautious, but a newcomer following these recommendations may well have fewer problems in the long run than an experienced cow boy.

The manual includes explanations of self-test error codes, and provides full pin-out specifications of the various ports. Also described are procedures for option installation and machine configuration. It is a good manual and is well suited to the beginner, as well as providing sufficient detail for the more experienced users.

Prices

The news is not as bad as one might think.

A standard Telecat with 20Mbytes hard disk, 1.2Mbytes floppy, 512k RAM, keyboard, serial port, parallel port, display adaptor, monochrome monitor, MS-DOS and GW Basic has a recommended retail price of \$5995. For this money, you receive a system with all the bits and pieces required to start work immediately. Many other machines quote prices which are exclusive of the screen and other vital items.

Since the Telecat comes with most equipment as standard, there are relatively few options available. However, users may wish to add a colour screen, second floppy, second hard disk, or additional memory.

Conclusion

The Telecat reeks of quality, incorporates innovative designs, and seems to have struck that vital combination of features which shot the M24 to success in the PC market.

It's shortcomings are few. The processor is only 8MHz, it has no reset button and the hard disk is slower than most, even considering the optimising disk controller.

It is a likeable machine, exuding that same what-ever-it-was which spurred my M24 purchase. Best of all, it comes at a very reasonable price.

Do not be surprised if you hear a great deal more about this machine.

Osborne AT

Everyone remembers Adam Osborne and his Osborne portable computer which sparked the explosion of portable computers onto the market. Most people also remember Adam Osborne's many books, and the time when he was known as the James Martin of the PC world - a not necessarily flattering thing to say about an author. I certainly remember Adam Osborne at the first ACS PC conference in Sydney, and the uproar he created by expounding his corporate philosophy, that "mediocrity is the key to success". Most people remember the crash of his computer company soon afterwards, and the happy smiles from those other companies who strived for excellence and were still around to talk about it. Undaunted, although slightly less vocal on the subject of mediocrity, Osborne Computer has

risen again, like the proverbial Phoenix from the ashes.

The latest product from Osborne is an AT-compatible. Now, 'AT' stands for 'Advanced Technology', and it is perhaps indicative that Mr Osborne has had to revise his corporate policies since he did not call his machine the 'Osborne MT' (Mediocre Technology).

Hardware

The Osborne AT is an 80286 machine manufactured entirely in Taiwan and 'badge engineered' with an Osborne label. The machine falls into the low end of the AT market, running its processor at 6MHz with one wait state. Physically, the machine measures 54cm x 42cm x 16cm and weighs around 19kg.

The motherboard contains the 80286 processor, with a socket for the optional 80287 numeric coprocessor. Three PALs are used to reduce the minor chip count. All the usual support gear is there, including dual 8259A PICs, an 8237A DMA controller, 8254-2 timer/counter chip and an MC146818 clock/calendar chip. The clock is battery backed, using a bank of four AA Duracell non-rechargeable batteries. 64k of ROM is provided, containing the bootstrap and power-on self test routines. Additional sockets are provided for another 64k of ROM, if required.

The machine comes equipped with 512k of RAM, implemented in two banks of 256k chips on the motherboard. By inserting extra chips, memory capacity can be raised to 1Mbyte without the need for additional boards. Interestingly, while

AT-COMPATIBLES

most other ATs maintain their system configuration entirely in CMOS RAM, the Osborne AT also uses a bank of four switches plus a multitude of jumpers. These control aspects such as keyboard type, ROM chip type, monitor type and various RAM configurations.

The unit includes a 195 watt power supply, switchable between 230 and 115 volts. The power switch is a large orange one of the IBM kind located for easy access at the side of the machine, towards the rear.

The ubiquitous AT standard LED console is located stylishly in the centre of the case, providing a system key lock, power indicator and DASD access indicator. Delightfully, a recessed red reset button is also provided. This means that when the inevitable system hang occurs, with interrupts disabled so that control /alt/delete do nothing, you don't have to power the system off and back on again, just hit the little red button. If you hang your system regularly (as I do), then the reset button will greatly prolong the life and reliability of your machine, as most wear and tear takes place during power up.

In fairness to the Osborne, it can also apparently be run in a zero wait state mode. Running in this mode would improve performance above that of a normal IBM PC/AT. The machine is shipped running with the wait state, and a jumper can be switched to select the faster mode, and a diagram in the manual shows the location of the jumper on the motherboard. To run interesting benchmarks, I decided to drop the beast into top gear. The jumper is located in one corner of the motherboard, directly underneath the hard disk drive. Removing the drive does not provide access to it, however, as the drive slots into a metal mounting bracket. It seems to me that you would need to remove all the expansion boards and connectors, and unscrew the motherboard in order to access the jumper. Unfortunately, the Osborne is a machine which is very easy to strip down, but damn near impossible to put back together. Things which can be easily unscrewed and slid out simply don't want to go back without a fight. For this reason, the benchmarks shown here have been run with the wait



state imposed, as the machine is shipped that way, and all but the most adventurous users will probably end up leaving it like that.

Incidentally, the well known Norton Utility, SI was run on the machine to obtain Nortons 'Performance Index'. Now, this index is notoriously unrepresentative of actual performance obtained in everyday use, but it does tend to be repeatable. Running it on the Osborne, however, SI claimed various performance indexes ranging between 4.8 and 5.5, and at one point, even claimed a 12.9. The median index, however, seemed to be about 5.1.

Eight expansion slots are provided, five of which are AT-compatible 16-bit slot, the other three being PC/XT compatible 8-bit slots. A floppy/hard disk controller card comes installed in one of the 16-bit slots, and a display adapter would normally be installed in one of the 8-bit slots.

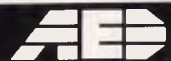
The floppy disk drive is 1.2Mbytes built by Mitsubishi. It is a rather neat half height, with lots of space underneath it for a second drive. A small panel fits over the second drive area, and shows through

the casing. In fact, there is room enough for a third drive, or half height tape backup unit. A clever bit on the casing can be removed to allow access to the third device, if present.

The Winchester disk is a trusty 30Mbytes Seagate, manufactured in Singapore, but fitted and tested here in Australia. The drive is a stepper motor type, with an average access time of 40ms, compared with 37ms on an IBM PC/AT.

The review machine came equipped with a monochrome graphics adaptor and Thompson monochrome amber monitor. Now for a spot of background material. IBM has two standard display adaptors, the CGA colour graphics adaptor which uses a memory mapped display based at address B8000, and the MDA monochrome text adaptor which maps into B0000. The CGA can do average graphics, but terrible text. The MDA can do great text, but absolutely no graphics. The latest thing from IBM is the EGA, which can do pretty good graphics and pretty good text, and is the shape of

**To find out how to link IBM PCs in
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things to come for the next couple of years.

A few years ago Hercules released its monochrome graphics adaptor. The idea is, and it's a great one, people need high quality text and they sometimes want to do graphs, but few applications really need colour. A great idea. The problem was, Hercules should have built something that is either compatible with the CGA, MDA or both. This is most certainly possible, and comes as standard equipment in every Olivetti M24. The problem was, that Hercules tried to be both things at once, and ended up being compatible with neither. Unmodified software which does anything clever with the screen simply will not run correctly on a Hercules card, and this is why products like Lotus 1-2-3 need special Hercules drivers.

To make things worse, several Taiwanese companies started bringing out Hercules style cards which aren't even compatible with the Hercules, let alone the real standards. The Osborne AT can be supplied with either a CGA compatible card or a Hercules compatible card. Now I'm not sure whether or not its monochrome graphics card is a good clone of the Hercules (it exhibited one or two tell-tale problems), but to a certain extent it doesn't really matter. Hercules is on the way out. When you order one of these machines, think carefully about what sort of work you will be doing with it, and possibly consider a true MDA or EGA compatible board.

Anyway, after all that, the mono adaptor board also includes a Centronics compatible parallel printer port. There is no serial port on the machine, although you could readily plug one into an expansion slot.

The keyboard is the same as the IBM PC/AT keyboard, in terms of layout, labelling and the position of the toggle indicators. The board has a reasonable feel to it, and includes pop-up feet at the rear.

System software

The Osborne AT is delivered with a very standard MS-DOS version 3.1. No extra commands or utilities have been added to this DOS by Osborne, so it may provide a higher degree of PC-DOS compatibility than some of the more customised MS-DOS versions. Normally, MS-DOS is highly compatible with PC-DOS, and problems only occur with products which burrow their way into the operating system and do things they really shouldn't.

The machine can also run Xenix, of course. The only notable omission is the

absence of the Microsoft GW Basic interpreter.

The Bios is implemented in 64k, although, I suspect that the 64k isn't completely used. The Bios performs a complete self-test upon every cold boot, and an abbreviated form on each warm boot.

One interesting and potentially very useful feature of the Bios is the ability to set a password for boot time. Using the PSW130 utility, passwords can be set and altered. When the system is rebooted in any way, the Bios asks for the password to be entered, locking up the system after three bad tries such that the system must be cold booted. This validation takes place before the boot track is read from disk, so booting off a foreign floppy is no way around the security.

What would overcome the security is removing the internal battery so that the CMOS RAM loses its contents. However, if the computer is secured using the key lock, access to the inside of the machine would only be possible using a hacksaw. As computer security becomes more important, particularly in the rather exposed area of PCs, this single feature may influence buying decisions more than any number of high-tech gadgets.

Compatibility

No application software is provided with the machine. The Osborne AT seems to have a high degree of AT-compatibility, and so the entire library of application software for the IBM machines would be equally applicable to this computer, not-

withstanding previous comments concerning monochrome graphics adapters.

Documentation

The Osborne AT is provided with a very standard MS-DOS Reference Manual and Users Guide. These are from the Microsoft stable, and so are as good as any other MS-DOS documentation.

Additionally however, an MS-DOS Programmer Reference Manual version 3.1 is supplied. These are like hens teeth, and very expensive to buy when you eventually find one. The Asian duplicators don't produce them because the demand is so low. You may not have any need for this material yourself, but you can certainly sell the manual for a song to any budding programmer developing a product.

A ring-bound Hardware Users Guide is also provided. This document describes the installation, care and feeding of the Osborne. It includes pictures of an Asian gentleman unpacking his new AT, and such gems as "the size of a hard disk will also determine the amount of data that can be stored on the disk".

The manual is certainly written in Taiwan, but most of it is pretty good, even if a little wordy in places. The manufacturers probably enlisted the services of a good technical translator. Late additions to the manual are of a lower quality, for example "If you set the password, when the computer is power on or warm reset, the Bios may request enter the password. If password is error, it can let you try three times, if OK then

Osborne AT Turbo

Just as this was going to press, Osborne introduced a new upgraded version of its AT machine, called the AT Turbo.

The main difference between the original AT and the new one is processor speed, 10MHz to be exact. This makes the Osborne far more competitive with the other low end AT compatibles. Additionally, Osborne has redesigned the motherboard to make greater use of VLSI.

Other features remaining the same include the 30Mbytes 40ms hard disk, 512k RAM expandable to 1Mbyte on the motherboard, eight expansion slots, and the lack of a serial port as standard equipment.

An enhanced keyboard provides a vast improvement over the IBM standard. The board is somewhat larger, includes separate cursor, editing and numeric keypads and conforms to the new 12 function key standard set by IBM.

In general, the machine is not well engineered. The motherboard is unstable,

the expansion port brackets do not fit properly and the case appears somewhat warped such that it does not match up with the screw holes unless persuasion is applied. The disk controller card, once removed, simply refuses to be replaced.

While we would have liked to run benchmarks to demonstrate the enhanced speed of the machine, sadly the floppy disk drive catch refused to operate and we were not able to load the benchmark software.

This machine is a Mitac, badge engineered with the Osborne label.

No doubt many of these problems are peculiar to the early release models, and will be rectified in later production runs.

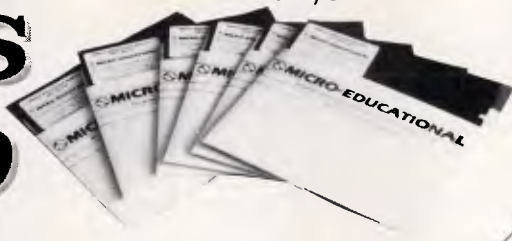
Osborne has not yet finalised pricing, but initial indications were that the price would be the same as the original Osborne AT, with the price of that unit dropping accordingly. Osborne also plan to introduce a floor stand to allow desk-side mounting.

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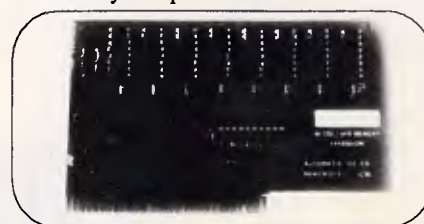
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Technical specifications

Processor:	80286 running at 6MHz
RAM:	512k expandable to 1Mbyte on motherboard
ROM:	64k
Keyboard:	84 keys, standard AT layout
Display:	CGA or Hercules compatible mono graphics
Weight:	Approximately 19kg
Dimensions:	54 x 42 x 16cm
I/O:	Parallel printer port if mono graphics card used, eight expansion slots
Mass storage:	1.2Mbytes floppy disk drive, 30Mbytes hard disk with 40ms average access time
DOS:	MS-DOS 3.1

Bios continues reading. The ENTSPW program is a menu-driven". The meaning is clear, but the presentation certainly qualifies as 'Chinglish'.

Prices

Prices start at \$3495 for a machine with no hard disk, then move onto \$4500 for a more typical configuration with 20Mbytes disk and 512k of memory. From there, a 30Mbytes disk system costs \$5400, or a

44Mbytes computer for \$6200.

These prices include a choice of monochrome or colour/graphics display adaptor, but do not include the monitor itself.

Conclusion

Many computer buyers head for the known names. It's unfortunate when a name which has been around the traps for quite a while bears no relation to the

Benchmarks

BM1	0.6
BM2	2.1
BM3	4.2
BM4	4.4
BM5	4.7
BM6	8.3
BM7	12.9
BM8	13.1
Average	6.2

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

machine you're buying, except for a bit of badge engineering as the machine goes out the door.

That is not to say that the Osborne AT is a loser. Far from it. The Osborne provides good cost effectiveness and performance, and will set you back much less than some of the other known names.

Tandy 3000

There was a time when Tandy ruled the microcomputer market (jointly with Apple, of course), but since those halcyon days of the TRS-80, Tandy has just never quite had it as good. When the MS-DOS revolution started, Tandy brought out its Tandy 1000, an unfortunate machine which offered most of the disadvantages of being IBM-compatible without actually managing to be compatible. This was later rectified with the Tandy 2000, a true IBM compatible.

Tandy has now entered the AT stakes with its Tandy 3000, which Tandy describe as "the business machine for over-achievers".

Hardware

The most noticeable characteristic of the 3000 is the fact that this machine has a smaller desk footprint than most of the other AT compatibles. Being only 48cm x 45cm x 16cm, the 3000 is roughly the same size as the old IBM PC. This is not due to any lack of goodies internally, rather Tandy has just organised the inter-

nals more sensibly. Most of the monolithic ATs include vast expanses of empty space. I suspect this is an AT specific marketing strategy which goes something like: "We're going to put in a processor which costs about \$200 extra, and we're going to charge a couple of thousand more for it, so we'd better make the box really big and heavy". Tandy has realised that the most valuable real estate in the world is the top of an executive's desk and, as such, small footprint machines have instant appeal.

The Tandy 3000 runs an 80286 processor at a clock rate of 8MHz, and comes complete with 512k RAM as standard. The motherboard is well laid out, uncrowded, and can be expanded to 640k without additional boards. A socket for an 80287 numeric coprocessor is provided although on the machine provided for review, this socket had a small 14 pin socket with a resistor soldered onto it, plugged into one side of the 80287 socket. No doubt, this piggy-back socket can be removed when the 80287 is to be mounted.

The power supply is of the sealed cage type, suitable for 240V only. The power switch is located in the standard IBM position - at the side and towards the rear of the case. This provides easy access without the possibility of accidental power loss. A transparent plastic flap, hinged on the power supply, extends forward to the disk drive assembly and over to the disk controller card, and is prominently labelled "Do not operate with this cover removed". I cannot imagine the purpose of this flap. It could not possibly have any insulation value, not does it affect the air flow. Perhaps it has something to do with static.

A total of 10 expansion ports are provided, seven of which are AT-compatible 16-bit ports, the other three being 8-bit ports, one of which is suitable only for half size cards. One of the 16-bit ports is taken up by the disk controller, one of the 8-bit ports is occupied by the display adaptor, and the half size port contains a parallel/serial adaptor card. This leaves six 16-bit ports and one 8-bit port for additional expansion.

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The Tandy 3000 is another of those machines which inhale cooling air through the front panel, ejecting it through the rear. Normally, these machines diligently suck in all the dust, smoke and other refuse, then carefully draw it all through the floppy disk drive. Not so the Tandy. The fan is mounted on the front panel, and all air is sucked through an aluminium air filter which may be removed for cleaning. The value of this filter is proven by the fact that the review machine, presumably not very old, had dust coated all over the filter, while the internals remained shiny and new. Most machines which draw unfiltered air through the front panel end up a real mess internally. Tandy's attention to detail will greatly improve the life and reliability of the machine. The filter, incidentally, can be removed and cleaned without removing the system cover.

A battery-backed clock/calculator is included, which is powered by a Duracell DL233A lithium battery pack, and fastened to the chassis with velcro tape. The power on and disk access indicators are located at the left of the front panel, just below a red reset switch. These reset switches are of the greatest value, as a full system hang-up can only be recovered by powering down unless the switch is provided. Most of the wear and tear to the electronics occurs at power-up time, so avoiding the unnecessary power-down can greatly improve the longevity and reliability of a computer.

This computer, comparatively speaking, is a real thoroughbred. The motherboard is manufactured by Tandy in Texas, as are the case, keyboard, display adaptor card, and even the parallel/serial adaptor. The monitor has been manufactured specifically for Tandy Australia in Japan, and the disk controller card is by Western Digital - a good name in disk controllers.

A 1.2Mbytes half height floppy disk drive is provided, with a 20Mbytes half height hard disk mounted below it, tucked away deep in the chassis. Between the two drives, space is provided for an additional half height device. It is here that Tandy has made its footprint savings, as most other AT manufacturers mount hard disks and floppies next to each other,

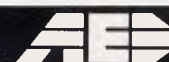


leaving space for an excessive four additional half height devices. The hard disk is a Mitsubishi, with a stepper motor providing an average access time of 85ms. This is very slow by AT standards, and not too sprightly even by XT standards. By way of comparison, most AT disks provide around a 40ms average access time. Users contemplating heavy disk-based applications may need to consider the installation of a faster disk.

There are five display cards available for the Tandy 3000, three of which are actually from the Tandy 1200, and cover the standard MDA and CGA conventions. The model 3000 specific adaptors include the Deluxe Text Adaptor, which is a text-

only card with background and foreground capability. The Deluxe Graphics Display Adaptor, provided with the review machine, is basically a CGA card, but with 8 x 14 characters. This is a neat trick, and becoming more common. The CGA standard provides terrible 8 x 8 characters which become very tiring to read after any prolonged period, whereas the true MDA provides good characters, but can perform absolutely no graphics. Tandy seem to have implemented the same trick as Olivetti did in the M24 (the first machine to pull it off, I believe). It did manage to provide a true CGA compatible card while providing decent characters when in text mode. Some manufacturers,

**To find out how to link IBM PCs in
the world's most integrated
network, turn to page 12**



such as Compaq, do this by actually building the two adaptors (CGA & MDA) into the one box and switching between them. Others, such as Sperry, do it in such a way that the lovely 8 x 14 characters revert back into 8 x 8 under some software.

Tandy has done something different yet again. The card contains 64k of memory, extending from B0000 all the way up to BFFFF, which makes it look as though both the CGA and MDA are in the machine, but it doesn't seem to be actually pretending to be both. To confuse matters even more, the card can perform underlining while also displaying in colour, something of which the CGA is simply not capable. Even the M24 can't do that.

As well as as the standard CGA modes, two additional graphics modes are provided. The card can support 640 x 400 in four colours, and 320 x 400 in 16 colours. No software will take advantage of these high resolution modes without additional drivers, but the board is compatible with the Super Res 400 and Graphix Plus II boards from STB, for which drivers are available. This compatibility isn't surprising, as the board was designed and manufactured by STB.

The text mode trick seems to work well. The usual graphics tests run without problems, and the card maintains its 8 x 14 font throughout. One or two strange things happened with some software (lack of colour, spurious reverse video), but I am convinced that with suitable configuration these funnies could be eliminated.

If you're not yet ready for the expense of an EGA, this board seems to provide a solution to text/graphics at least as good as Olivetti's, and potentially better, without introducing the risk of non-standard Hercules-type resolutions.

The colour monitor provided is a rather chunky beast, but works adequately. As mentioned, it is of Japanese origin, and was manufactured especially for Tandy Australia. A panel on the front flips open to reveal contrast, brightness and horizontal centring controls. The rear of the unit presents more controls, but sadly all are unlabelled, and none are explained in the documentation. The monitor had a vertical hold problem when unpacked, so a little experimentation proved necessary. Two of the mystery controls are knobs, while the other four are heavily-recessed trimmers, best adjusted with a plastic screwdriver. One of these handles vertical synchronisation.

The keyboard is an extremely lightweight job, connected to the system unit by a two metre coiled cable. The layout conforms exactly to the IBM PC/AT standard, right down to the sym-

bology and key sizes. The only difference is that the toggle indicators are on the keys themselves, rather than set off on the casing. Different people have different tastes in keyboard feel, but to me, this one feels a little clattery.

In conclusion, this machine is well constructed and has been engineered with thought. The noise level, although higher than many PCs, is a great deal less than many AT clones. It could easily become a pleasure to work with.

System software

The operating system is MS-DOS version 3.1 with no major OEM extensions. It is provided complete with the Microsoft Library Manager, LIB. All the other normal MS-DOS utilities, such as EDLIN, LINK and DEBUG, are included.

Happily, this machine also comes complete with the Microsoft GW Basic interpreter version 3.11. Although no-one would do any serious work in it these days, a Basic interpreter is a handy thing to have around. Version 3.11 of the interpreter is not significantly different to version 2, the main additions being file-sharing support. Strangely, Tandy has not adapted the Basic at all, not even to the point at which it could support the higher resolution graphics modes offered by the Deluxe Graphics Adaptor.

But sadly, this is an appallingly slow Basic. I'm not too sure why, but it just is. The benchmark times shown are for the Tandy Basic. Running the same benchmarks using GW Basic version 2 from my M24 produced times around 25 per cent less. One other comment: the Basic has a rather annoying habit of not displaying the cursor when you're in the process of moving it. This may have been associated with the Deluxe Display Adaptor problem, although the M24 Basic didn't exhibit the same behaviour.

This machine, naturally, can also run Xenix. This would be of interest to users with multi-user requirements who do not need to run MS-DOS applications.

Compatibility

The ROM Bios used in the Tandy 3000 comes from Phoenix Software, the company which produces most of the IBM compatible Bioses. As such, the Bios presented no compatibility problems and could reasonably be expected to function reliably. With so many manufacturers using Phoenix Bios the software must be pretty much bug-free by now. The Bios in the review machine was of a mature August 1985 vintage.

Application software

As well as providing access to the virtually infinite library of software for the IBM PC/AT, the Tandy 3000 includes a bundled application package. Bundled software is becoming rare these days, as most users have their own very definite ideas about what software they want to use, and will not generally adopt a package purely because it's included in the purchase price. The Tandy software, however, does not attempt to compete head-on with the major applications which most people would tend to use. Instead, it is a handy pot pourri of slightly integrated applications which no-one would use seriously, but could be very useful for those application areas which do not warrant the purchase of a full package.

Called Deskmate, the software provides a complete desk-top set of application packages. Included are an elementary word processor, spreadsheet, database, communications facility, calendar, mail system and alarm clock. None of these applications is terribly powerful, and the degree of integration is only slight. Files can only be passed between the various modules if the modules involved deal with simple ASCII files, but that does mean that the word processor and communications modules can deal with the same files quite successfully. Nevertheless, all modules present a consistent and easily used user interface, with all interaction

Technical specifications

Processor:	80286 running at 8MHz
RAM:	512k standard, expandable to 640k on motherboard; expandable to 12Mbytes with additional cards
ROM:	64k
Keyboard:	84 key AT layout
Display:	CGA and MDA compatible adaptors available as well as Deluxe adaptor cards
Weight:	21.3kg
Dimensions:	48.2 x 45.7 x 16.5cm
I/O:	Serial, parallel, 10 expansion ports
Mass storage:	20Mbytes 85ms hard disk, 1.2Mbytes floppy disk
DOS:	MS-DOS 3.11

EARTH

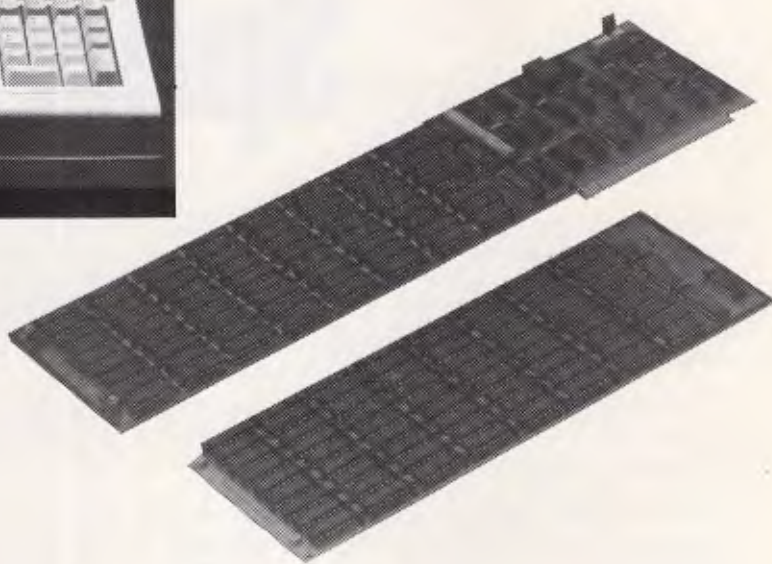
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AT-COMPATIBLES

being through function key menus.

The modules are really quite limited. For example, the communications program cannot perform file transfers other than simple non error-checked ASCII file transmission and capture. The mail module assumes that everyone will be using the same machine, and the spreadsheet provides only about one dozen functions. The database is a file manager of about the PFS File level. A useful background alarm facility is provided, and all components are very easy to use.

This package is a good give-away. A user whose machine spends most of its time doing database activities using dBase might, for example, use Deskmate for occasional letters and infrequent simple spreadsheets. Deskmate is not a packaged answer to everybody's business requirements. It is, however, a useful adjunct.

Documentation

Like many Tandy products, the documentation for the 3000 is excellent. Three ring bound manuals are provided. The MS-DOS manual is the standard Microsoft one, complete with light weight, introduction and a quick reference card. A plastic insert contains the DOS system and supplemental program diskettes.

The GW Basic manual is, again, the standard Microsoft one and, as such, is of high quality. However, it contains little in-

formation specific to the model 3000, and no quick reference guide is provided for Basic.

A manual is also supplied for the Deskmate software. This is composed of a reference manual, tutorial and quick reference card. These manuals are definitely of a different flavour to the rest, but are still quite good, as they include many screen images, and make effective use of different fonts.

Finally, a small paperback installation manual is included. This describes vital activities such as installation, troubleshooting, options, configuration, and backups, and provides an overview of the various keys, buttons and lights.

A separate manual for the Deluxe Graphics Display Adaptor was also provided with the review machine. Most users would have absolutely no need to refer to this document, although for the more adventurous, it is packed full of vital information describing the enhanced graphics modes, and describes how to program the 6845 controller.

Prices

The basic machine with 512k and 20Mbytes hard disk costs \$8999. This price includes the display adaptor board. The monitor, however, is an extra, costing either \$349.95 for monochrome, or \$1149.95 for colour.

MS-DOS is priced separately in case anyone goes for the Xenix option. The

DOS costs \$199.95, and includes the Deskmate software as well as the GW Basic interpreter and manuals.

Conclusion

The Tandy 3000 is a class act, no doubt about it. However, like many AT-compatibles around town, it is neither the cheapest, nor the fastest.

It does have the advantages of being well-engineered, relatively small, and coming from a well-known company. Unfortunately, Tandy is not well known for its value for money, and this machine carries the handicap of a very slow hard disk. Despite this, the 3000 is probably one of the most pleasant AT-compatibles for the price.

Benchmarks

BM1	0.7
BM2	2.1
BM3	4.0
BM4	4.2
BM5	5.1
BM6	9.5
BM7	14.4
BM8	11.2
Average	6.4

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Sperry IT

Following well established AT lines, the Sperry IT is a large box, best suited to placement alongside a desk, rather than on it. Sporting the traditional security key and DASD symbology, the IT even manages to weigh more than the real McCoy.

The IT seems to be following the original AT philosophy which was multi-user. However, the vast majority of ATs are being used as fast single user machines mainly because buyers can either run multi-user under Xenix (and be lacking somewhat in software), or they can have access to all the top end user type software by running single user under MS-DOS. Sperry, however, seems a little more serious about multi-user than

IBM was. Although the IT makes a very adequate fast single user machine, it is somehow easier to imagine it as the mythical departmental processor.

Hardware

The IT runs an Intel 80286 processor at either 6.7.15 or 8MHz. The speed is switch selectable, accessed either through a panel on the rear, or by removing the cover and flicking dip switches, depending on the model you are lucky enough to get. The 6MHz one wait state mode is provided for IBM PC/AT compatibility.

I can't really imagine anyone running the IT on less than full speed, and while

it's nice to see that Sperry can let the 80286 have its head at a full 7.15MHz, this doesn't make it the fastest AT compatible around.

Two levels of IT are supplied by Sperry. The first is considered to be the single user system, and roughly corresponds to the IBM entry level AT, consisting of a single floppy disk drive, 512k RAM and no hard disk. Standard equipment includes a parallel printer adaptor (nicely compatible with the IBM version of the Centronics interface), two serial adaptors (more on these later), a choice of display and a choice of keyboard. The multi-user configuration adds a 40Mbytes Microscribe full height hard disk and an extra 512k RAM, taking the total to 1Mbyte. This

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would be the minimal system most users would contemplate.

If there is one feature which characterises this machine, it has to be the number of serial ports. They're everywhere. With two serial ports as standard equipment, extra ports can be added using multi-terminal adaptor cards, each of which sports four serial ports. Up to two of these boards can be installed, thereby providing a maximum of twelve ports. This is where the multi-user angle comes in. The IBM PC/AT can only support three serial ports, thus making the whole multi-user issue somewhat limited. Who wants to go to all the hassle of running Xenix just to have a system which cannot grow past four users? The Sperry, in comparison, has got true growth potential, and possibly makes the whole bother of multi-user worth thinking about.

More options are available for the keyboard. The preferred choice is the Sperry enhanced keyboard. This departs from the PC/AT convention, providing a separate numeric and cursor pad, function keys across the top, separate editing keys and delineated regions. The PC keyboard is a standard PC style keyboard with a number of subtle variations. The third keyboard is the PC/IT, and seems to be just about identical to the IBM AT keyboard.

Three different display adaptors are available: monochrome, medium resolution and high resolution colour. The review machine was supplied with the top of the line and, while it was a very nice display, naturally all of the MS-DOS graphics software could not drive it to its highest resolution. A well known nasty with the IBM PC/AT is the quality of the character font when using a graphics screen. IBM still uses only an 8 x 8 font on its standard adaptor board, which makes the characters very dotted - a strain for lengthy text work. Olivetti, with the M24, managed to maintain graphics compatibility while switching into an 8 x 16 font in text mode, thereby giving the best of both worlds. For a while it looked as though Sperry had managed the same trick. Unfortunately, while the normal text font is significantly better than 8 x 8, certain useful pieces of software, such as Borland's Turbo Pascal, kept switching it back to an 8 x 8 font. Despite this, Sperry certainly managed to achieve graphics compatibility, with Flight Simulator and Jet running well.

Memory options come on 2Mbytes cards. Up to two of these can be installed, adding to the initial 1Mbyte to produce a grand total of 5Mbytes.

The floppy drive can either be a 360k PC compatible, or a 1.2Mbytes (96 TP) AT compatible. The review machine was



equipped with the 96 TPI drive, and it worked flawlessly throughout.

For expansion, eight full size slots are provided, six of which are 16-bit slots, and two of which are 8-bit slots. Not all of these slots are completely usable, however. Each of the multi-terminal adaptor cards is double bracketed; in other words, although they only consume one of the actual slots, they occupy two of the back plane holes.

Included as standard is one serial/parallel board. This is also double bracketed, but does not take up more than one slot due to a thoughtful arrangement on the mother board. An additional slot is occupied by the hard and floppy disk controller boards as well as a display adaptor board. This leaves one spare 8-bit slot, and four spare 16-bit slots.

An optional 80287 arithmetic coprocessor can also be installed. Velcroed to the back of the system unit are the batteries for the CMOS clock calendar.

When the review machine first arrived, the disk had a loud pitched scream

whenever operating. With time, this scream reduced to a murmur, but not before alarming one or two visitors with a particularly loud outburst. Presumably not all of the hard disks have this problem, and I am sure Sperry would be quick with a replacement if anyone had the misfortune to actually purchase a screamer.

System software

If Sperry really wants to pursue the multi-user aspect of the IT, surely what is needed is some decent multi-user software.

Let's not get this confused with multi-tasking software, such as Concurrent PC-DOS and Concurrent CP/M, which allow the one user to run multiple programs at the same time. Similarly, much of the PC software which is called multi-user is in fact LAN based, which means that you need a separate computer for each user, and a cable running to a central machine which controls the database.

True multi-user means you have one machine - one chunk of memory, one CPU and a whole heap of RS232 ports on

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the back into which you can plug dumb (or semi-dumb) terminals. Since MS-DOS does not yet support multiple users, Xenix is the recognised route. However, Sperry has managed to port Mapper, a mainframe based 4GL to the IT and, through it, provide some degree of true multi-user capability.

Personal Mapper fits strangely with the IT. First of all, a portion of the hard disk must be reserved for its use via the FDISK utility.

FDISK allows you to partition your hard disk into separate areas which are totally non-accessable to each other, and is usually used when two operating systems must be installed on the one hard disk.

Personal Mapper also requires the addition of a Mapper board. This device provides a Motorola 68010 processor, several PLAs (programmable logic arrays) a 32MHz crystal which is divided down to probably produce an 8MHz clock, and additional memory. The Mapper board can also be installed in IBM machines, simply by flicking a few switches.

Thus the end effect of installing Personal Mapper is really to have two computers in one.

Naturally, by taking this approach, the multi-user capability is only available within Mapper - you still cannot run multi-user Lotus or Multimate, or any other PC software which is not designed for true multi-user use.

Why port mainframe software to a PC?

Why indeed. Mainframe software is almost always less friendly, less intimate and less easy to use than PC software. It is also usually more powerful - but at what cost in terms of usability?

Mainframe software stands out like a sore foot on a PC. It's the stuff that can't scroll sideways in real time; always requires you to keep pressing Enter; makes little use of the extended character set; seems to be caught up in mainframe operating system terminology and has less than ideal performance.

However, consider an organisation with a Sperry mainframe running mainframe Mapper. As the user load increases, upgrades are necessary. While additional disks or a few extra megabytes are not terribly expensive, the inevitable processor upgrade certainly is. There are mountains of people trained in the use of Mapper, and dozens of Mapper applications currently being used.

To this corporate user, the prospect of shifting a number of those applications onto departmental PCs, without recoding without retraining, and thereby saving mainframe resources would be something too good to pass up.

Personal Mapper seems to be a full implementation of mainframe Mapper. To ease the transition from mainframe to PC,

the keyboard conventions are that of mainframe Sperry terminals. A template provided illustrates the reassignments.

A full description of Mapper is probably not appropriate as those corporate users who are going to be intensely interested already know all about Mapper and those non-corporate users are probably not going to be very interested.

Personal Mapper is supplied with a suite of four boxed manuals, encompassing installation and administration, software reference, getting to know Mapper, and RUN designer reference. Clearly each of these manuals is targeted at different types of user. I found them all rather heavy going, full of RIDs and RUNs. For the non-Mapper reader, a better section on terminology and an overview would have been useful.

Compatibility

No compatibility problems appeared with the IT and it happily ran commercial software as well as Microsoft's Flight Simulator and Jet.

Documentation

The documentation provided with the system is of the same ilk as the IBM stuff. Included with the system are a System Installation Guide, MS-DOS 3.1 Users Guide and Microsoft GW Basic. A small box of diskettes holds MS-DOS and the diagnostics routines which include a facility to 'park' the heads prior to transportation.

Finally, as far as I could tell, the machine is almost entirely manufactured by Mitsubishi in Japan.

Prices

Mapper retails for \$4250. The basic Sperry PC IT unit comprises of a single floppy with 512k RAM and retails for \$6500. A monochrome monitor \$395 and display controller \$499. A medium resolution colour monitor costs \$1400, and the display controller is \$557. A high resolution colour

monitor \$1931, and a display controller \$1375.

An extra 360k drive costs \$575, or a 1.2Mbytes drive retails for \$775.

A choice of two keyboards: the professional \$375 or the standard IT keyboard \$312.

A 40Mbytes hard disk system with 1Mbyte RAM costs \$10,500.

An expansion kit to make 2Mbytes costs \$3950. The system is expandable to 5Mbytes.

A 60Mbytes tape back-up unit costs \$3996. An extra 40Mbytes hard disk costs \$4350. The hard disk controller costs \$995.

To use the IT as a multi-user system you need a multi-terminal adaptor \$525 (up to eight users). Each screen then needs a terminal adaptor cable \$97.

And the all important Xenix 5 operating system costs \$1460. A math coprocessor costs \$750.

Conclusion

The Sperry IT is, on the surface, just another AT-compatible. It is, however, a good compatible. It provides enhanced functionality in some areas, as well as enhanced performance. More importantly, Sperry seems to be seriously pursuing the multi-user capability.

Personal Mapper should be of great interest to the corporate Sperry mainframe user.

Benchmarks

BM1	0.7
BM2	2.0
BM3	3.8
BM4	3.9
BM5	4.7
BM6	8.9
BM7	13.3
BM8	10.6
Average	5.9

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	Intel 80286 running at 6, 7.15 or 8MHz
RAM:	512k or 1024k, expandable up to 5Mbytes
ROM:	32k
Keyboard:	84 key PC style, 84 key AT style or 98 key Enhanced
Display:	Monochrome, medium resolution colour, high resolution colour
Weight:	21.6kg
I/O:	Centronics parallel, two 9-pin RS232 serial, expandable up to 12
Mass storage:	360k or 1.2Mbytes floppy, 40Mbytes hard disk, optional internal streaming tape backup unit
DOS:	MS-DOS 3.1 or Xenix

Zenith Z-200

Zenith produce a whole range of PCs, ranging from the low-end PC-compatible Z-100 series up to the latest AT-compatible Z-200 machine examined in this review.

Zenith is a subsidiary of Heath, the company well known for its expensive, but high quality Heathkit electronic projects, upon which people fulfilled themselves for many years until Dick Smith came along.

The Z-200, in many ways, is uniquely a Zenith. It's not cheap, but is of high quality and just a little bit different. Zenith machines are distributed in Australia by Anitech, which also has a division dealing in Alpine car Hi-Fi.

Some of the differences found in the Z-200, to be examined later, mean that this machine has a far greater potential for expansion than many of the other AT-compatibles, and is positioned well to keep up with new technology, such as the 80386 processor.

Hardware

The Z-200 conforms to the standard IBM PC/AT packaging conventions, being a cream and grey box with separate keyboard and monitor. Physically, the machine is of almost identical dimensions and weight. Internally, however, things start to diverge.

The case is easily removed by attacking six screws, two on the rear and two on each side. The cover then slides neatly forward to reveal the innards.

On the surface, the Z-200 sounds very much like a standard AT. It runs an 80286 processor at 6MHz, but runs it with no wait states, thereby outperforming the standard 6MHz IBM PC/AT. It is equipped with 512k of RAM as standard, and comes with a 1.2Mbytes floppy disk drive and 20Mbytes Winchester drive.

Removing the cover however, shows that Zenith has taken a radical departure from the standard PC/AT engineering approach. The Zenith takes a step back to old S-100 bus style internals. S-100 was a convention used many years ago, in which a computer consisted of only a backplane board containing sockets and a power supply. Enthusiasts could then plug into the backplane any CPU, memory and peripherals they liked. These days, S-100 has pretty much disappeared,

and PC manufacturers are trying to cram as much as possible on to a single motherboard in order to keep costs down.

In the Z-200, the main circuit board is an incredibly small backplane, measuring only 28cm x 21cm. This backplane contains three AT-compatible expansion ports, one PC compatible expansion port, and six Zenith specific expansion ports. In addition to the ports, it also holds the keyboard socket, a couple of rectifiers, an AA size lithium battery, six power indicator LEDs and that's all!

All of the major components normally associated with a computer (CPU, memory, controllers, etc), are situated on boards which plug into the Zenith specific expansion ports. The CPU/Memory board contains an 80286 processor completely shrouded in a metal heat sink, 12MHz crystal, 512k of 150ns dynamic memory, and other components required to make the 80286 actually run. Two ROM chips hold the Zenith Bios (more on this later), with sockets for two additional ROMs. Space for an 80287 numeric coprocessor is also provided.

Undoubtedly the machine supplied for review was quite an early model, as the CPU board was quite a mess. Certainly the board was a maze of tracks, but several late engineering revisions had meant the addition of numerous hand soldered wires, both on the front and rear

of the board. Even a few 1k resistors were found hiding on the back of the PCB. No doubt, later runs of the CPU board will incorporate these revisions into the PCB layout, but even if you do happen to get an early board, the modifications are well soldered, and firmly anchored with resin.

The I/O board holds the dual 8259A programmable interrupt controllers (from NEC), an Intel 8254 counter/timer, DMA controller, keyboard interface, real-time clock and various other bits and pieces, including a curious bank of 16 large inductors. This board is essential to the running of the 80286, but also provides a AT standard Centronics printer port, and a 9 pin D type serial port. The I/O board also sports one or two late revisions, but not to the extent of the CPU board. A connector for the speaker and front panel LEDs feed from one end of the board, just near a bank of six small diagnostic LEDs.

A video adaptor board also plugs into one of the Zenith specific expansion ports. This board is optional; and provides standard IBM CGA functionality, and can drive both RGB and composite monitors. It uses a standard 6845 controller chip, and hence provides a high degree of CGA compatibility. This board, too, has quite a few late engineering revisions, including several severed tracks. The CGA adaptor works extremely well, providing very little flicker and banding. The final board is the





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floppy and hard disk controller card, containing only one late revision and capable of driving up to three Winchesters and two floppies.

Zenith would seem to be doing something quite clever by implementing its entire machine through the expansion ports. Upgrading to new technology, such as an 80386 processor or EGA display adaptor, is simply a matter of plugging in a replacement board. On machines which put everything on the motherboard, these types of enhancements are either kludges, or involve replacing the entire motherboard. However, the Zenith boards are about two centimetres longer than normal IBM-compatible boards, and use 86-pin rather than 62-pin edge connectors. This means that only Zenith boards can be plugged into the Zenith slots, and so installing a new processor board means waiting until Zenith actually produce one. This isn't too bad, as IBM-compatible slots are also provided, and so in the worst case, you'll be no worse off than if you bought a machine with everything on the motherboard.

The power supply is a totally encased 200 watt unit (the AT has a 195 watt supply), mounted in the rear of the case. It is switchable between 240v and 110v, and includes a fan mounted towards the side of the unit. The power on/off switch is almost completely inaccessible, being a small discrete grey switch situated about seven centimetres from the side of the case, on the rear. The switch isn't too bad to use once you're used to it, but the initial search for it can be quite harrowing.

Internally, the Z-200 is most definitely not crowded. About 40 per cent of the system width is dedicated to the expansion ports, with the remainder allocated to the disk drives and power supply. The supply is even smaller than it looks, as a bracket is fitted over one end to enhance air flow. The drives are both half height, with enough space underneath them, it seems, for four additional drives. Certainly Zenith's intention is not that this space be used for additional drives, as both the chassis and case provide no access to this area, and so custom installation would involve the use of a metal nibbler. No doubt Zenith has plans for this cavern, as otherwise it could have mounted the drives vertically, and reduced the footprint by about 15 centimetres.

The quantity of free space within the unit must certainly help cooling, as the airflow within the case is terrific. Many machines cool themselves by sucking unfiltered, dusty air in through the front of the unit, blowing it over the disk drives, and then ejecting it from the rear. Not so in the Zenith. The Z-200, very sensibly, inhales from the side and passes the air

through a filter before circulating it through the unit. This must do wonders for reliability in an office environment. If you want, try this experiment on your own machine (or preferably a friend's): light a cigarette and blow smoke in the general direction of the computer, observe how the machine carefully draws the smoke through the floppy disk drives. Cooling air is expelled through a vent running across the front of the case. When the machine is first powered up, it blows cold, air over the fingers of the keyboard operator. After a few minutes, however, this turns into a pleasant warm breeze. Quite nice.

The floppy disk drive is a standard 1.2Mbytes drive which can also read and write to 360k disks. The Winchester in the review machine was a 20Mbytes NEC device with a stepper motor drive. The hard disk is available in both 40ms (millisecond) and 85ms speeds, compared with 37ms on a real IBM PC/AT. Why anyone would bother to run an 85ms disk on an 80286 based machine is a mystery, so when you're ordering, make sure you specify a 40ms Winchester.

One usual aspect is that the standard power and DASD access lights found on the IBM are also on the Z-200, but in addition, there is a small red light on the disk itself. One would normally expect the light on the disk to flicker in time with disk accesses, but not so. The light on the disk indicates power, and so is always on. Until you get used to it, it leaves you constantly thinking the system has locked up with the disk selected, which, of course, it hasn't.

The keyboard is of the normal IBM style, with pop-up feet and a good five foot cable. The layout is half way between the PC and AT standards. The ESC key has been moved back to the old position, the back slash key is underneath the Enter key, and the tilde is between the alt key and the space bar. Apart from these differences, the keyboard includes most of the features found on the AT, including LED indicators for the toggle keys, mounted actually inside the key rather than on the case. All key labels are English with accompanying symbols, that is, no key is labelled purely by a graphic. The keyboard isn't too bad, although a little clunky by some standards. Audio feedback is provided automatically by a discrete tone which can be disabled.

The monitor is large and heavy, and is as good as, but not noticeably better than most other monitors. Controls on the front deal with power, contrast and brightness. Additional recessed controls on the rear allow adjustment of focus, width, height and vertical and horizontal centering. The monitor plugs into a separate 240v outlet.

In terms of performance, the Z-200 is pretty good. It claims to be 33 per cent faster than the PC/AT, due to its no wait state technology. The Z-200 certainly shapes up well in the benchmarks, not a leader, but a great deal faster than a PC. The Peter Norton system performance index, incidentally, rates this machine at 6.6. This indicator is in no way representative of the performance the machine will deliver in a normal working instruction mix, and so should not be taken too seriously.

All in all, the Z-200 is a fine machine internally. Very noisy compared to my M24, but not as noisy as, for example, a Sperry IT.

System software

A peculiarity of the Z-200 comes to light when you need to boot off a floppy. On almost every other MS-DOS system around, one would simply place a floppy in drive A: and hit control, alt and delete. Doing this with the Zenith results in a reboot from the Winchester. No matter how hard you try, the Z-200 boots from the Winchester. After due consultation with the manual, it comes to light that the bootstrap ROM has more than meets the eye.

The Z-200 contains 64k of ROM, which holds not only the bootstrap loader and POST (Power On Self Test), but also the MFM-200 monitor program. This monitor is almost identical to the MS-DOS debug command, but is resident in ROM and can be branched to before the boot by hitting control, alt and insert.

All of the usual Debug facilities are provided, including breakpoints, tracing, register manipulation, disassembly and memory manipulation. Added to this, however, is a Boot command which can be used to boot from the non-default drive. This is quite handy, as users often reboot their machines with data disks in the floppy, which on other MS-DOS machine would cause a bootstrap error (if the floppy was non-bootable).

Other commands offered in the MFM-200 monitor are a self test facility and a full screen Setup command to alter the system date and time, as well as configuring memory size and optional peripherals.

The idea of a ROM resident debugger is very attractive to someone who spends a lot of time writing low level MS-DOS drivers in assembler. Unfortunately, it does not seem possible to 'hot key' into the monitor without also rebooting the system. No doubt someone will come up with a clever hardware modification to provide this facility.

The Z-200 can run either Xenix or MS-DOS, and is supplied with MS-DOS 3.1.

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The DOS is a good one, heavily enhanced by Zenith. Extra commands include BOOTF which disenables the Winchester and boots from a floppy (fine if you can boot the Winchester, otherwise the MFM-200 monitor must be used); CIPHER for encryption/decryption; CONFIGUR for I/O port configuration; RDCPM to read CP/M format disks; SEARCH which is similar to the public domain WHEREIS utility; and the essential DETECT utility which can be used to locate and disenable bad sectors without losing all your data.

Optional system software includes a full self-test package. The system performs a very quick self-test each time it is powered up, and can perform more extensive tests from the MFM-200 monitor. The optional disk performs a complete and thorough self test, similar to that found on the IBM diagnostic disk.

Compatibility

Like most IBM PC/AT compatible machines, no application software is included in the purchase price of the machine (except MS-DOS). Similarly, no great library of Z-200 specific software exists. Instead, users draw upon the gigantic and constantly growing library of PC and AT packages.

This is what IBM-compatibility is all about, and that's fine if your compatible really is compatible. Fortunately, the Z-200 is quite compatible. Of course, there is no such thing as a legal 100 per cent compatible, as discussions about percentages of compatibility become quite meaningless. The important thing is that the Z-200 is sufficiently compatible that software for the AT, even 'badly behaved' software, runs successfully.

We tried several of the major software packages and all of them ran without difficulties. Additionally, since the Z-200 is only about 30 per cent faster than an IBM PC/AT, even software with timing critical copy protection schemes should have no problems.

The only noticeable omission was that no Microsoft Basic interpreter is provided with the system. This is quite a departure from the norm and, although few people do any serious work in Basic these days, it's a handy facility to have. The benchmarks shown here were run using GW Basic from an M24.

Documentation

With the Z-200 supplied for review, only the MS-DOS documentation was provided. This was more than your average MS-DOS manual, being an almost complete rewrite by Zenith, and done extremely well. It was also the thickest MS-DOS

Technical specifications

Processor:	80286 running at 6MHz
RAM:	512k expandable to 16Mbytes, 4k battery backed
ROM:	64k
Keyboard:	84 keys
Display:	IBM CGA, MDA and VGA compatible cards
Weight:	17.2kg
Dimensions:	53.3 x 41.9 x 16.5cm
I/O:	9-pin RS232C serial port, Centronics parallel port
Mass storage:	1.2Mbytes floppy, 20Mbytes Winchester
DOS:	MS-DOS 3.1

manual I've seen. It follows the same general flow as other MS-DOS manuals, but includes more detail.

To indicate just how much detail the manual goes into, the chapter on boot procedures is 20 pages in length, covering every different aspect of bootstrapping.

While the manual does not go as far as to detail DOS INT 21 function calls, it does contain a very useful section on system components, explaining the various pieces of MS-DOS, in what order they are loaded and what they do. This section provides valuable background information not even found in the Microsoft 3.1 Programmers Reference Manual. The usual additional topics are covered, including Edlin, Link, LIB (the library manager), Debug and the Detect utility.

Since the MS-DOS manual is so detailed, a much smaller document entitled Conversational MS-DOS, A Beginners Guide to MS-DOS Version 3 is included. This is an extremely user friendly and light weight manual, and provides a good introduction with which the average beginner can get started promptly.

Two other manuals are normally provided with the Z-200, a User's Guide which covers things like how to unpack the system and plug it in, and an Operations Manual. The MS-DOS manual refers to these two documents occasionally. Although we did not actually see these manuals, if they are the same quality as

the MS-DOS manual, then they should be very good.

Prices

The Z-200 has many different options, but a base system with 512k RAM and 20Mbytes Winchester sells for \$7695. This does not include a display adaptor board, which costs another \$599.

Options include an IBM-compatible monochrome display adaptor, and a memory expansion board. The memory board is specifically for the Z-200 ports, and contains 512k RAM as standard, expandable up to 1.5Mbytes on a single board.

Conclusion

The Zenith Z-200 certainly isn't the cheapest AT clone around, and neither is it the fastest. It is however, a quality box with a reputable background, and one of the few to offer a 'backplane' approach which provides greatest opportunity for expansion to new processors and better technology in the future.

Benchmarks

BM1	0.6
BM2	1.6
BM3	3.2
BM4	3.3
BM5	3.6
BM6	6.2
BM7	9.8
BM8	10.0
Average	4.7

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

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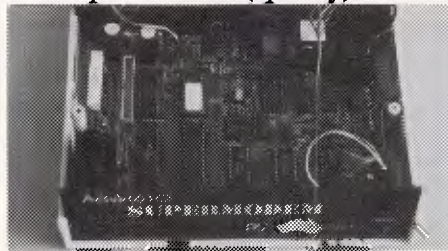


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DSE Multitech 900

When the DSE Challenger was laid to rest, Dick Smith Electronics released the Multitech 500. This was a highly affordable machine with a high degree of compatibility and good reliability. The quality still wasn't terrific, particularly in the keyboard, but the price was right. From there, the Multitech 700 was introduced as a higher quality, faster machine with a superior keyboard.

Now, Dick Smith Electronics has introduced the Multitech PC 900, an AT-compatible machine from the same stable as the other, highly successful Multitechs. No doubt the multitude of Dick Smith devotees will be extremely interested in this device, which is produced in the PC-compatible capital of the world, Taiwan.

Hardware

The PC 900 runs an 80286 at either 6 or 10MHz. In high speed mode, this makes the PC 900 faster than the top IBM PC/AT, and faster than many of the other compatibles, although not as fast as some others. Speed selection may be made either through a software utility, or through the keyboard. The provision of a separate utility is useful, as it allows the speed to automatically be altered through a BAT file before entry to speed sensitive software. A light on the front panel indicates the current processor speed, which may be changed without difficulty while the system is running.

Space for an 80287 numeric co-processor is provided, and the standard memory size is 512k, which may be expanded up to 1024k on the motherboard.

Eight system expansion slots are provided, two of which are 8-bit ports with the remainder being 16-bit ports. When the system is delivered, three of these slots are consumed by the disk controller, display adaptor and serial/parallel port cards. ROMs of 64k provide the Bios and power-on self test, with the ability to insert an additional 64k of ROM.

The power supply is of the sealed metal box type, with fan built-in. The switch is located on the rear of the unit, about five centimetres from the right hand side. Although switches located on the rear can be rather hard to find, the size and placement of this one means

that no lengthy search must be undertaken just to turn the system on. The power supply can deliver 200 watts of power, and is manufactured in Hong Kong.

A real time clock/calendar is battery backed by a small plastic container of lithium batteries which is velcroed to the inside rear of the case. Every different AT-compatible seems to utilise different lithium batteries, and the PC 900 is no exception. This raises availability questions, but buyers of real IBM PC/ATs face the same problem. In fact, when all the lithium batteries started running out a few months ago, availability was a major problem, so you'll be no worse off with a Taiwanese machine.

A traditional instrument panel on the left side of the front panel provides the usual DASD access LED, a 10MHz mode LED, keylock and reset button. The power light is located on the keyboard. The reset button is not at all recessed and requires only the lightest of touches to activate.

In quite a departure from other machines, the key in the keylock cannot be removed when the system is unlocked. In some ways this is an advantage, as it makes it harder to lose the keys and less tempting for the system to be left permanently in the 'on'

position. In other ways this is a disadvantage, as the keys may be removed by anybody wandering past the machine when it is in use while the operator has ducked off for a coffee.

Disk storage is a 1.2Mbytes Teac floppy disk drive and a 20Mbytes Seagate hard disk. The Seagate is a full height device with an average access time of 40ms, which makes it very competitive with the IBM machine, better than a lot of other compatibles, but not as good as some. Both drives are controlled by a single board which makes heavy use of the ubiquitous Western Digital controller chips.

Below the floppy drive is space for a second floppy or another half height device and, below that, room for a third. A small satchel of brackets provides all the necessary mountings for additional devices. Panels on the front are installed, or left in place if the device needs no external access, for example, a second hard disk.

The display adaptor is a Multitech MGA, monochrome graphics adaptor, and seems to be quite compatible with the Hercules de-facto standard for monochrome graphics cards. The Hercules standard is not a particularly good one, as graphics software needs special drivers or modification in order to run,



AT-COMPATIBLES

however, many of the so called 'Hercules-compatible' cards being found in several machines aren't even particularly compatible. The MGA, at least, is compatible with the Hercules standard and software such as Microsoft Windows, with the appropriate drivers, works well. The board also provides a parallel printer port.

A half size card delivered in one of the expansion ports provides a second printer port and two serial ports. The main serial port is situated on the mounting bracket of the card, and is accessed through a 9 pin D type connector, which is the standard on AT machines. The second serial port is optional, but was fully installed in the review machine. A ribbon cable runs from a connector on the circuit board to a dummy mounting bracket which holds a 25 pin D type connector. This is a great idea, as although the 9 pin sockets are the standard connector on ATs, most people have lots of 25 pin cables and most serial equipment is delivered with 25 pin cables, so the provision of the optional 25 pin port obviates the need for lots of 9 pin to 25 pin adaptor cables. The second serial port does obscure one of the other expansion slots, but with eight of them, most users should have one to spare if they really need the second port.

The keyboard is really quite good. A great deal larger than a normal AT layout, it bears little resemblance to the IBM standard. A numeric and cursor keypad on the right is identical, as is the function key array. The typewriter section of the keyboard has been subtly altered, but for the better. The back slash key, which is often used under MS-DOS, has been moved from next to the backspace key down to the left of the space bar. The asterisk key, another common one, appears not only in the numeric pad, but also on the right side of the space bar. These are terrific improvements, as key sequences such as '*.ASM' abound for most MS-DOS users, and the alterations between the IBM PC and AT keyboards gradually moved these keys into more and more inconvenient locations.

Inserted between the alphabetic and numeric pad areas is a separate cursor and editing key pad. This provides the arrow keys, insert, delete, page up, page down, home and end keys so that the numeric pad may really be used as a numeric pad without the sacrifice of the editing keys. Additionally, the separation between the various keyboard areas has been slightly increased, and the end result is a keyboard much larger than the normal AT board, but more usable.

The toggle key indicators are arranged in a panel above the numeric pad, in the

normal AT position, and are joined by a power indicator. The 'feel', although a little clanky, is a vast improvement over the 'RSI Special' found on the original Multitech 500 and should present no discouragement for potential buyers.

The only negative aspect of the whole keyboard assembly is that the cable feeds out from the right hand side of the keyboard, but the socket on the rear of the system unit is a couple of inches left of centre. This reduces the effective length of the keyboard cable. One of the nice features on the original Dick Smith Challenger was that the keyboard socket was on the front of the machine, thereby maximising the effective cable length.

The monochrome monitor is quite large and heavy, and includes a tilt and swivel base. The monitor obtains its power through a second cable connecting to the system unit, thereby cutting 240V outlet requirements. The display quality is really quite good, and easy on the eyes. Two recessed controls on the rear allow adjustment of vertical size and hold, and contrast and brightness controls are discretely placed under the front of the screen. A small green power LED confirms that the unit is healthy without disturbing the user's eyes. A very discrete button under the screen reverses the picture from white on black to black on white, which is supposed to be ergonomically better. When running Microsoft Windows, the black on white mode makes the screen seem very Mac-like. Since the reversal is switch controlled, users may cater to their own preferences without any software adjustment whatsoever.

In general, the unit is well engineered. Every component is easily accessed and do not obscure each other. The front panel indicator assembly, for example, simply clips on and can be removed in a matter of seconds. This is a good quality machine.

System software

The ROM Bios and power-on self test software is implemented in a 64k ROM, and is in no way remarkable. It has been produced by Award software, a relatively unknown source of Bios software, but the end result seems compatible enough. The system boots quickly, performing a very rapid equipment check before firing up DOS.

The DOS provided is MS-DOS version 3.1, embellished by a Multitech copyright notice. Apart from that, it is a very standard MS-DOS. Multitech does, however, supply a series of utilities with the machine, including its version of the Hercules HGC utility for selecting graphics compatibility modes. Other

utilities include a print spooler of similar quality to the standard MS-DOS spooler, the normal setup software and the speed selector. Most peculiar of all, Multitech delivers a collection of relatively useless utilities which will not actually run on the machine. These utilities will only run on 8088 based machines, which of course any AT is not. There seems to be no adequate reason for this dependency, as they do such boring things as setting the time and date, and constructing 8088 dependency into such a utility would be a real challenge. The big question, of course, is *why* distribute utilities which will not run on the machine you've just bought.

Compatibility

Apart from the somewhat obscure Bios, everything tried and tested seemed to run without any problems.

As well as having access to the gigantic library of IBM application software, Dick Smith bundle into the purchase price the popular integrated application package, Open Access II.

This is not the place for a full description of Open Access II, but suffice to say that it is a quite useful collection of integrated applications providing word processing, communications, spreadsheet, database, graphics and sufficiently powerful with which to build applications. Although many AT buyers will have their own fixed ideas concerning what software they want to run, some may not, and for those people, Open Access II could be a good place to start as it covers most low-end business requirements.

Open Access II is worth about \$1200 normally, but it's not too hard to pick it up for under \$800. No doubt the amount that it adds to the purchase price is far less than \$800, possibly only a few hundred dollars, so don't expect big discounts if you try to buy the PC 900 minus the software.

Benchmarks

BM1	0.3
BM2	1.1
BM3	2.6
BM4	2.7
BM5	2.8
BM6	4.9
BM7	7.5
BM8	7.6
Average	3.6

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

AT-COMPATIBLES

Documentation

The number of manuals which arrive with this machine is quite astonishing. The review machine was not supplied with documentation for Open Access, but it would, no doubt, be the standard Open Access manual which is of reasonably high quality.

The largest of the other manuals is the MS-DOS Users Guide. It is attractively ring bound and boxed, and is the standard Microsoft introductory document. In terms of size, it's about equal to many 'all-in-one' MS-DOS manuals, yet its contents only cover the vital intrinsics. A separate paper back supplement deals with the more esoteric facilities such as Debug, Fdisk, Vdisk and the curious utilities which won't actually run. This document is of lower quality, but still quite readable.

From here, we get into a whole bunch of manuals with catchy titles such as MDM-24 Operation Guide, KB097 Users Guide and SBT-AT Users Guide. Closer investigation reveals what these documents are all about. They describe the monitor, keyboard, display adaptor card, serial/parallel card, disk drive installation and the system unit itself. There are *seven* of these, none of very large, but what they lack in volume they more than make up for in quantity. Some of them are quite useful while

others go into unnecessary detail, such as keyboard controller commands. The Accel 900 Guide corresponds to the traditional Guide to Operations, dealing with installation, configuration and maintenance. This is really the only one worth reading, but unfortunately it is also the one which gets carried away about the keyboard controller. For most users, a quick flick through the Accel 900 Guide followed by depositing the rest of these things in the bottom draw should suffice.

In general, the documentation is good. Not great, but good.

Prices

For a Multitech PC 900 including 1.2Mbytes floppy, 20Mbytes hard disk, serial and parallel ports, display adaptor,

monitor, DOS and Open Access II, the recommended retail price is \$6995.

Conclusion

The PC 900 sits just above the middle of the AT market. It offers good performance, good quality and a good price.

Yet in all cases, you can find faster machines, machines of higher quality and cheaper machines. However, you probably won't find a faster machine with higher quality at a lower price including bundled software. If your sole selection criteria is price, performance or quality, you may well end up buying some other machine. However, for a good trade-off between all three, the DSE Multitech PC 900 is certainly in the running.

Technical specifications

Processor:	80286 running at 6 or 10MHz, software and key selectable.
RAM:	512k, expandable to 1024k on motherboard
ROM:	64k
Keyboard:	97 key enhanced AT layout
Display:	Hercules compatible monochrome graphics
Weight:	N/A
Dimensions:	53.2 x 41.5 x 16.7cm
I/O:	2 serial, parallel, 8 expansion slots
Mass Storage:	1.2Mbytes floppy, 20Mbytes 40ms hard disk
DOS:	MS-DOS 3.1

SUMMARY

The machines reviewed in this section offer an interesting cross section of the AT market. With the release of IBMs 8MHz AT, one would almost be forgiven for thinking that IBM has noticed the competition and been spurred on by it.

Users are looking at the AT machines predominantly for one reason - performance. Because of this, the vendors find themselves motivated to produce faster and faster computers. These days, 8MHz is standard, 6MHz is sub-standard, 10MHz is a little better than standard, and 12MHz upwards is offering clear superiority.

Confusing this somewhat is the aspect of wait states. Two machines running at 8MHz may not offer equal performance if one of them is inserting a wait state on each memory access.

Then there is the matter of disk speed. Some vendors offer true high speed voice coil devices, others opt for outdated technology which hangs like a lead weight around the neck of the machine. Still others utilise the cheaper, older technology, but attempt to upgrade its perfor-

mance in a more cost-effective manner through the use of clever disk controllers.

Finally, there is the matter of brand name.

The machines we have looked at run the entire gamut of every extreme. From the big name, average performance, high cost machines such as the Sperry IT, ranging through to the high performance, unnamed, low cost A*Star. In between these extremes, we have the big name, low performance, over-priced Tandy 3000, the renamed, medium performance, medium price Osborne and also the machines making subtle departures from accepted internal standards, such as the Zenith and APC IV. Finally, off in a class of its own, we have the Compaq 386. This is a pioneering machine, probably heralding the shape of things to come.

None of these machines is cheap. In almost all cases, you could buy two cheap XT-compatibles instead of the IBM PC/AT. In some cases, you could buy four XTs. However, the point of the ATs is performance. You could buy hundreds of PCs

instead of an IBM mainframe, but you don't see people throwing out their mainframes.

A clear winner is hard to pick, but I would have to say that the A*Star is probably the fastest and the cheapest. If I were to consider buying an AT machine, I would have to consider price/performance as the number one criterion. But then I am not concerned about support, as long as circuit schematics are available.

As an equal winner, the Televideo comes to mind. It offers medium level performance at a medium-to-low price, and also offers true brand name advantages. Its innovation in design provides a number of advantages in office usability. A prospective buyer of this machine need not worry about support or reliability, as it is a quality machine manufactured by a quality company and distributed in Australia by a quality bunch.

Of course, each machine offers its own relative advantages and no clear cut choice can be made without first considering each buyers individual requirements and circumstances.

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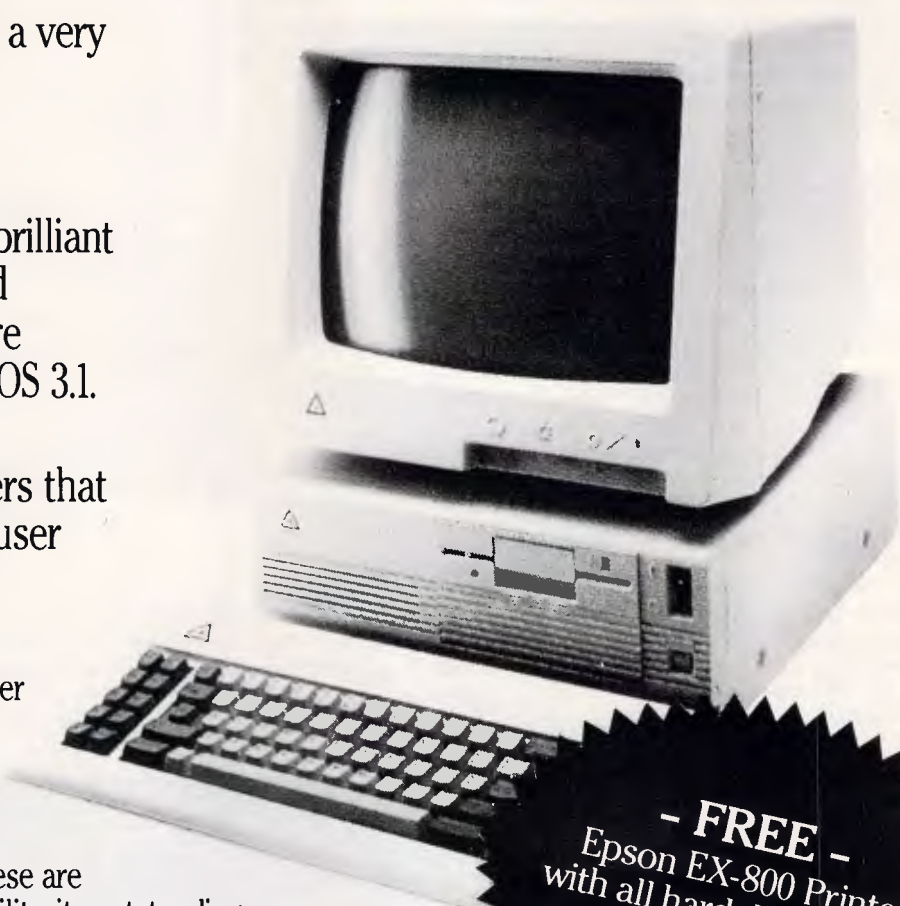
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Bondwell 8

The size of a portable PC might lead you to believe that they would be cheaper than desktops. That's not so. They use sophisticated technology to get their diminutive size, and frequently cost several times as much as a simple desktop PC. Also, too many are just too big to go in a briefcase, and need an external power source to run. So much for portability.

One portable breaks out of this mould. It is the Bondwell 8, a \$2450 Hong Kong machine that is definitely small enough to go in a briefcase. It may not be the most sophisticated of the portables, but it has a lot to recommend it.

It is designed in the typical portable style, with a grey 'clam shell' case. Its size is a meagre 28.4cm x 7.8cm x 31cm (that's 20cms shorter than the IBM PC Convertible) and, at 5.5kg (12lbs), just half the weight of the IBM. There's a fold out carry handle too, in case you don't have a briefcase.

Power for the Bondwell comes from internal batteries, giving six hours computing between charges. The two six volt, three amp batteries also power the single 3.5in 720k disk drive.

There's only one disk drive on the Bondwell, but there is a port so more storage can be added. The display is to a typical liquid crystal display (LCD) screen, and it can be backlit so you can work in dim light. The keyboard has 76 keys, with some overlapping of functions to give all the keys found on a desktop.

Displays have traditionally been the weak point of portables. LCD displays, in particular, suffer from poor contrast, poor definition and poor resolution. The Bondwell's is no exception, but on a machine of this price, you can't expect miracles.

Most LCD displays have a generous viewing angle, so you don't have to anchor your head in one position to see the display. The Bondwell viewing angle is rather narrow, ranging over only about 45 degrees. However, the screen can be tilted through 180 degrees (yes, it won't break if you push it right back), so getting a viewable display is not that difficult to achieve.

The keyboard comes complete with 10 function keys, a cursor keypad that doubles up to provide home, end, page up and page down commands, a misplaced ESCape key and a portion of the

alphabet keyboard that can be switched to act as a numeric keypad.

Given the dimensions of the Bondwell, the keyboard is a fair effort. The constrictions imposed by the size haven't hampered usability, and while it may not be a desktop quality keyboard, portable users will have no complaints.

The basic configuration of the Bondwell is pretty comprehensive, though there is little scope for expansion. It has 512k RAM, though this is volatile and the contents of all except the 32 bytes reserved for the real-time clock are lost when power is switched off. The designers have not tried to stretch the limits of the technology by incorporating something clever like a standby mode that didn't lose RAM contents, but such facilities inevitably mean users losing valuable data they have stored to RAM.

Hardware

Six screws hold the Bondwell together. If you only find four, look under the carry handle for the other two. Pry the case apart and you'll see the printed circuit board (PCB), occupying three-quarters of the bottom half. The rest of the space is

fully occupied by the batteries (accounting for most of the Bondwell's weight) and a vertically mounted power supply board. This contains an easily replaceable fuse, unlike the IBM, with which a blown fuse means sending off the whole power supply to a service centre.

In the top of the case is the keyboard, a power on LED, the display and the inevitable speaker. Three short cables join the two halves of the case, and these must be disconnected to get at the innards.

Processing power for the Bondwell comes from an 80C88 processor running at 4.77MHz, the same speed as the 8088 in an IBM PC, and giving much the same processing speed. The C in the chip designation indicates that it is a CMOS version of the 8088, and so uses only a fraction of the power. Still, it lacks the speed of a fast 8088 or an 8086. If you want that, buy a cheap desktop.

A bank of 16 chips provides the 512k RAM. The power supply sends 12 volts to the disk drive and considerably less to the PCB. There is a small heat sink, but disk power bypasses it, so it is adequate for the job.

Recharging takes 12 hours, effectively



PORTABLE PCs

overnight, but the machine can be used while recharging. As with all rechargeable batteries, treat them carefully by not leaving them fully charged or fully drained for too long.

The power light is visible with the case closed and flashes when power is getting low in enough time to find a power outlet. For overseas travellers, a 110 volt, 13.8 volt output charger is needed.

Although the Bondwell is made in Hong Kong, most of the components are Japanese. The 80C88 is an OKI product, manufactured under licence from Intel. The display processor is a Yamaha unit, but has Microsoft copyright on it. Bondwell stickers adorn several of the chips, including the 8k Bios ROM. The smaller chips are from American makers such as RCA and Texas Instruments. Users wanting maths processing power will be disappointed as there is no socket for an 8087 chip.

The 720k 3.5in disk drive is an Epson unit, running with a Mitsubishi controller chip. It is shock mounted, though don't let that lull you into believing the Bondwell will stand being dropped from head height. It's opening is on the right of the machine, and there is an 'in use' light that is practically invisible during normal use.

The LCD display shows 25 lines of 80 characters. The display area measures 22.4cm x 7cm. It supports the full IBM character set and five graphics modes. Flashing and reverse character attributes are provided. A backlight can be switched on or off, and contrast is adjustable with a wheel at the side of the main casing. It needs to be on full contrast to be usable.

The display has a good refresh time, but the problems with the viewing angle and contrast make it the weak point of the machine. If you want a better display, be prepared to pay a lot more for your laptop.

The LCD screen has a primitive greying system to indicate colour. However, if colour is important to you, there are two options. The Bondwell has ports for an RGB or an NTSC monitor. Only the former, a 9-pin IBM D type socket, will be of use in Australia, and the display backlighting must be switched off to prevent interference with the RGB display.

If you like the potential of expansion ports, you'll love the tiny Bondwell. We've already mentioned the two display output ports, and the socket for the AC adaptor.

The rest of the output ports are hidden behind a flap at the rear of the machine. For starters, there is a serial port. This is implemented through a CMOS version of the 8250 chip found in an IBM PC, called a 82C50A. It doesn't generate true RS232C power levels, due to the 12 volt power supply, but will quite happily com-

municate with a PC at 9600 Baud, and cope with other devices that need high TTL levels.

The port is a 9-pin device, and if your cables all end in the more established 25-pin plug, you'll need a 9 to 25-pin adaptor. In small machines, everything is kept as small as possible, including the ports.

Another interface is for a parallel Centronics printer. Bondwell has again gone for an odd pin configuration, using the 15-pin standard instead of the more popular 25-pin standard. A 15 to 25-pin adaptor may be difficult to track down, but Bondwell has such a device in its catalogue. The manual provides pinout documentation, so you could also try building your own cable.

The final port for an external disk drive is either 5.25in or 3.5in. The connection is a 25-pin D type, again non-standard, but Bondwell seems set on this course. With a 5.25in drive fitted, you'll be able to load all your PC software, even the stuff that's not on 3.5in disks yet.

There is no modem in the Australian version of the Bondwell 8, though the American version has an internal 300 Baud modem. Lack of Telecom approval prevents this option being included in the local version. As there's no RS232C pin for a 5 volt power supply, mounting your own internal modem is not possible either.

System software

Our sample of the Bondwell 8 came with a single 3.5in MS-DOS diskette. It contained MS-DOS 2.11 and several utilities. MS-DOS features GW BASIC and the linker. The utilities included the Microsoft Macro Assembler, although there was no documentation for this.

Another utility was a set-up utility, providing a full screen interface to the Mode command, for setting screen modes and RS232C port configuration.

Modem 8 is another utility supplied. It is a rough and ready, menu based dumb terminal emulator with file transfer capability. The protocol used is Ward

Christensen, and the utility appeared to be bugged when transferring files larger than 16k. If you wanted to transfer software into the Bondwell from another PC, this would cause problems, but a simple Basic program could be written to allow file transfer of larger files. Modem 8 is no substitute for packages such as Crosstalk and Carbon Copy.

The 3.5in disk drives means that the PC software market is not wide open. While a growing number of software suppliers are putting their software on 3.5in disks, the market is not yet big enough to support this in a major way. Your choice will be restricted if you are after less popular programs.

With a file transfer program, software that is not copy protected can be loaded and run. Protected software, games and UCSD p-system software can't be communicated by this method, so you will have to buy a 5.25in disk drive to run it.

With the MS-DOS there is a RAM disk utility. You can use this to set aside portions of the 512k RAM as a super fast disk, but as the RAM contents are not retained when power is turned off, what you store in the RAM disk will be lost.

Compatibility

While we can't test every bit of PC software on a PC compatible, the Bondwell seemed to have no problems running the packages we tried. Graphics were handled well too.

Benchmarks

BMI	1.4
BM2	5.1
BM3	10.9
BM4	11.2
BM5	12.2
BM6	22.0
BM7	33.4
BM8	35.2
Average	16.4

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	80C88 running at 4.77MHz
RAM:	512k
ROM:	8k
Keyboard:	76 full-stroke keys
Display:	Backlit 80 x 25 LCD screen
Weight:	5.5kg
Dimensions:	28 x 7.8 x 31cm
I/O:	RS232C serial, Centronics parallel, RGB, NTSC composite, disk expansion
Mass storage:	One 3.5in 720k disk drive
DOS:	MS-DOS 2.11

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Documentation

Bondwell provides three manuals with its portable computer. The GW Basic manual is a rehash of the standard Microsoft documentation. It is not a great rehash, as it refers to a machine that is not the Bondwell. So, it does not mention the cursor control or editing keys and makes numerous references to control characters. With a bit of work, it can be sorted out.

The MS-DOS manual is adapted from the Microsoft version, and is all but identical to the manual supplied with other MS-DOS machines. Again, little effort is needed to work out how to apply it exactly to the Bondwell.

The third manual is the user manual for the Bondwell 8. It is a Bondwell product and pretty good. The first section deals with switching the machine on, setting it up and how to use the batteries.

The second section is excellent. It describes how to use the machine and all the MS-DOS commands, to the extent that it could replace the MS-DOS manual. There are plenty of diagrams and examples, and sections explaining why various features exist. Each section also has a 'what to do if something goes wrong' too, describing possible errors and cures.

The English in the manual is not Oriental, and the text reads well. In fact, most users will be able to use this manual and forget about the other two.

The user manual also describes the Modem 8 package, and how to use the RAM disk. Finally, it has copious appendices, describing the ports, their pinouts, memory addresses of devices and controllers, the character set and a glossary.

Prices

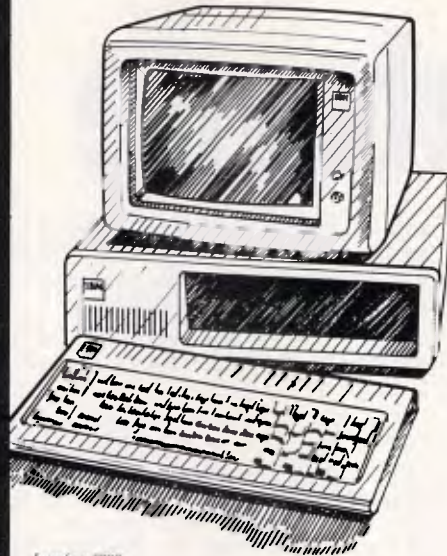
The Bondwell 8 with 512k RAM, one 720k floppy disk drive, backlit 80 x 25 LCD and MS-DOS 2.11 sells for a retail price of \$2400.

Conclusion

The Bondwell 8 is not one of the most exciting laptops on the market. However, it is one of the cheapest, and one of the smallest. It fits the needs of the majority of people who would want to use a laptop, and won't break the bank.

On the minus side, the LCD display is not one of the best, and there is no room for internal expansion. On the plus side, there is the \$2450 price, the screen backlighting and the modest dimensions. It adds up to a desirable laptop for those who want PC-compatibility, portability and a minimal outlay.

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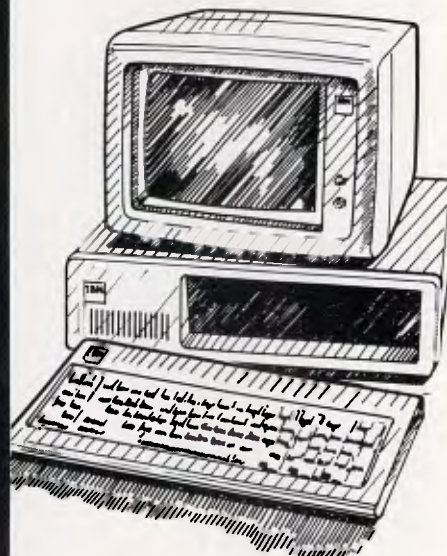
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Sotec PHC-16

Datavue 25

The modern portable micro is a device that sits on your lap, runs from internal batteries, has one or two floppy disk drives and a liquid crystal display. It is in complete contrast to the suitcase-size 'luggable' computer that had one or two floppy disk drives, a CRT display and needed mains power.

Falling squarely between these two camps is a brand new machine from Japan, the Sotec PHC-16, also known as the Datavue 25. The machine is currently being imported by (as far as we are aware) two sources: Intelligence Systems and Viatel Computers, both in Victoria. Intelligence Systems obtain its machines from its parent company in the US and call it the Datavue 25, while Viatel Computers import direct from Japan and call it the Sotec PH-16. To be fair to both parties the machine will be referred to as the Sotec/Datavue. Please note, however, that prices and details obtained for this review were from Viatel Computers.

In size, the Sotec/Datavue has the dimensions and weight of a sewing machine. It has an internal 3.5in disk drive, and a built-in 20Mytes hard disk drive. It also has a gas plasma display. So, it is a lot more powerful than most laptops. The price of around \$6300 means it is considerably more expensive too. Maybe it is best considered as a 1986 'luggable', rather than a laptop.

Hardware

To the uninitiated, the Sotec/Datavue looks like a portable sewing machine, housed in an off white case. A substantial fold out handle at the top reinforces this impression. In its carry state, it measures 33cm x 15.3cm x 26.5cm, and weighs a quite considerable 6.6kg. That won't break your back, but the size means that the machine is definitely not a briefcase computer.

The hard disk version of the computer has a battery pack permanently installed, and must be run off the mains. A 1.3m power cord is supplied. The machine is also available, for \$3400, with an LCD

screen, and one 5.25in disk drive or for \$4100 with a gas plasma screen and a 5.25in drive. In those configurations, it can be run from the batteries.

The keyboard clips on the front of the machine, covering the display. Push in a latch at the top and it comes clear.

The first surprise is that there is no cord connecting the keyboard to the CPU. The link is by an infra-red light beam. This means that you can operate the computer either from the other side of the room, or from the desktop. I've always detested cables, and infra-red links seems the way to go.

The only limitation with an infra-red keyboard is that it must be more or less in front of the CPU. You can be a good distance away, but if the CPU can't detect the light beams, you'll get no response to your commands. You'll also get no response if the four AA size, 1.5 volt batteries in the keyboard go flat.

For those who want the security of

cable connection, yes, it is available. The socket is a four pin min-DIN type, and the machine's distributors will sell you the appropriate cable.

The keyboard has 84 keys, a light to indicate that key signals are being transmitted to the CPU, two tiny fold down legs, and a cover for the battery compartment.

The keys duplicate all those of a desktop PC. Cursor control keys are mapped over the numeric keypad, and the function keys are in grey, to differentiate them from the other keys. A recessed panel will accommodate a card with function key descriptors on it.

On the lap, the keyboard feels rather flimsy. It is far better resting on a desk. The keys have a rather short movement and needs a firm press to register. Rapid typing is rather difficult, and as far as portable computer keyboards go, this one gets two out of five.

In comparison to the complaints made



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about liquid crystal displays, the gas plasma screen of the Sotec/Datavue is wonderful. It is backlit, positively glows amber on black, or vice versa, and is very readable. Gas plasma screens can cope much better with grey shading to represent colour graphics too and, if this weren't enough, the machine has ports for monitors that we'll deal with later.

The drawbacks with gas plasma screens are two fold. One, they are expensive, but in this machine, the cost seems to have been contained. Two, they use a great deal of power. However, as the Sotec/Datavue needs mains power to run the hard disk, you've got that anyway. So, it all benefits on the display front.

Continuing our brief tour of the machine, we'll find plenty of evidence to justify the price of the machine. On the right hand side is the 3.5in disk and the hard disk drive. On the left is access to the memory card, and a large cavity for a modem or other half length card.

On the rear, you'll find serial and parallel printer ports, output for an RGB monitor and a composite video device, an expansion port and a socket for an external disk drive. This is a computer built to take almost anything you care to think of.

Six easily found screws hold the front and back halves of the machine together. Unplug two ribbon cables and the PCBs are fully accessible.

To expand memory, there is no need to do this. The banks of RAM chips can be accessed through a cover in the right of the casing. A tab enables the connecting ribbon to be pulled from its socket, and the twin RAM boards can be slid out. Maximum RAM is 1.2Mbytes – and that's what the hard disk machine has, with the memory board bearing 32 chips. The cheaper configurations are fitted with 256k.

Inserting more RAM is simply a matter of removing the memory board and slotting the chips in. With the 1.2Mbytes configuration, 640k is reserved for system memory, 360k can be set aside for a RAM disk (drive C:) and the remaining 24k can be used as a buffer and to store the screen image. Setting the size of the RAM disk and whether to have a screen buffer or not can be done manually at start-up. Alternatively, by setting dip switches, this will be done automatically at power-up.

The Sotec/Datavue comes with 2k of CMOS RAM in place, to preserve the date and time of the real-time clock. This too can be upgraded, to 8k, so a programmer could store more data permanently in RAM. The CMOS chip is inside the main casing, on the bottom of the unit, and the manual has full details

about replacing the chip and accessing its memory.

Inside the machine there are chips aplenty. The back half of the casing holds the disk drives, two PCBs at right angles to each other, a small speaker, the memory card and has space left for a half length expansion card. The front half contains the power supply and the gas plasma screen. The power supply is sealed, so a blown fuse will mean a trip to a service agent.

The power supply has a large heat sink, but the hard disk, floppy disk and gas plasma display mean the casing does get a little hot with extended use. Both drives have power lights, and pressing a three key combination gives an instant guide to the state of the batteries (not relevant with AC supply, but meant for the portable, LCD version). There is also a battery level indicator light on the front panel. The central processing unit is our old favourite, the 80C88, a CMOS version of the Intel 8088, from Japanese maker, OKI. It runs at 4.77MHz, the same speed as the desktop PC. For the mathematically minded, there is space for an 8087 maths coprocessor, to speed up number crunching.

Sotec is emblazoned on one large chip, and this holds the native ROM routines, more of which later. The Bios ROM, visible through the expansion card cavity, is also proprietary, and is dated April 11, 1986.

The rest of the chips are a mixture of Japanese, US and Korean. OKI, Toshiba, Ricoh, Texas Instruments, NEC and Mitsubishi are among the names on the various chips, with OKI and NEC supplying the big guns. There are a few holes on the lower PCB, but with the casing together, there's not much space left inside the machine.

Inside the cavity where a modem card would sit, there is a bank of three sets of eight dip switches. These dictate, among other things, the amount of RAM installed, whether an 8087 is in place, the monitor type (if you are using an external monitor), the number of drives installed, whether to automatically install the RAM disk, whether to carry out ROM

and RAM checks on power-up, whether to supply continuous power to the disk drives and which font set to use. Set these switches according to what's in the machine and your preferences.

The gas plasma screen display measures 22.7cm x 11.3cm. The screen can be angled in any of six settings up to 45 degrees. Using ctrl, left shift and another key, the display can be altered to any of six modes, driven by a V6355 chip. It has bit addressable graphics, giving 640 x 200 dots in the graphics mode. Colour is mimicked by eight grey intensities in one of the text modes. In normal text mode, the display is a full 80 characters by 25 lines. The intensity bit can be enabled for WordStar type programs. There is an inverse video mode, CRT mode and one display mode can be customised by programmers.

Pressing 't' with the ctrl, left shift keys presents a display showing the default settings of dip switches, their functions, and what various ctrl, left shift, key combinations do.

Various key combinations toggle through the six display modes, increase and decrease the screen contrast, switch to inverse video, toggle backlighting on and off, alter the volume of the internal speaker, select external display, check battery level, swap drives A: and B: and toggle between a block and an underline cursor. Customising the machine to your requirements takes only a few seconds.

There is a great variety of ports to take advantage of. On the front, there is the

Benchmarks

BM1	1.7
BM2	5.5
BM3	11.2
BM4	11.5
BM5	13.0
BM6	24.0
BM7	36.7
BM8	33.7
Average	17.2

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	80C88 running at 4.77MHZ
RAM:	1.2Mbytes
ROM:	8k
Keyboard:	84 full-stroke keys, infra-red link
Display:	Backlit 80 x 25 gas plasma screen
Weight:	6.6kg
Dimensions:	33cm x 15.3cm x 26.5cm
I/O:	RS232C serial, Centronics parallel, RGB, composite video, disk expansion, expansion bus, AC adaptor
Mass storage:	One 3.5in 720k disk drive; 20Mbyte internal hard disk
DOS:	MS-DOS 2.11

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four pin mini-DIN plug for the optional keyboard cable. Next to it is the keyboard signal receiver.

On the right is an AC adaptor plug, which isn't needed with mains power being provided, but could be used to run the computer from a car battery. There is also a reset button, for those times when an application hangs up.

The two disk drives – hard and 3.5in –

are also on the right hand side. Both have power lights. The hard disk has a cooling fan in the back and runs with a muted whirr that is not disturbing to the user.

On the left, there is a power socket, and a sealed battery pack removal button. It doesn't work with the hard disk version of the machine. Top left is the abovementioned access to the memory boards. Below that is another removable

panel covering a cavity for a half-length modem card and the dip switches. This cover has a small panel within it that can be removed to get a power supply to the modem. Sendata is building suitable modem cards.

The back of the machine is really where the goodies lie. Next to the power switch is a standard, 25-pin, D-type serial interface, for an external modem, printer or other device. Alongside that is a 25-pin, D-type parallel Centronics printer interface. CMOS chips control I/O operations, to reduce power consumption.

Next, there is a standard nine pin RGB port, for colour monitor use. If you are using a television, there is a composite video co-axial socket provided.

The Sotec/Datavue outputs 16 colours, and for applications where colour is important, you can switch off the gas plasma display and have all the benefits of a monitor.

There are two more ports – for an external disk drive and a proprietary expansion unit.

The review machine was supplied with an external 5.25in disk drive, and a plate so this can be mounted on the back of the unit, adding 2kg to the weight. It costs \$650, plugs into the disk drive expansion port and is addressed as drive B:. With this outfit, you have a 360k RAM disk, a 3.5in 720k disk, a 5.25in 360k disk and a 20Mbytes hard disk. There's plenty of memory and you'll be able to run virtually any MS-DOS software on a machine that is readily portable.

The expansion unit, costing \$1300, can accommodate up to three expansion boards and is available with an optional 20Mbytes hard disk drive. With that in place, you have all the power of a desktop.

System software

The software supplied with the Sotec/Datavue is a 3.5in disk containing MS-DOS 2.11 and another diagnostic disk. The distributor will also let you have eight disks of public domain software, from a library of some 500 disks. The choice is up to you.

The machine also has some software of its own built-in, consisting of a world time clock and a remote terminal program.

The world time clock can be accessed at any time. When called, it displays times and dates in 24 cities, using the real time-clock in the machine. A follow on screen allows the user to alter the date and time, city names and time difference from GMT. For a Sotec/Datavue user on the move, leading a jetsetting life, it is a

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reasonable application to throw in, but for those of us who get overseas once a year, it's a bit of a gimmick.

The remote terminal emulator is more useful. Again, it can be called up at any time, but you'll need a cable to another computer, or a modem to use it. Baud rates from 110 to 9,600 can be set, with odd, even or no parity, one or two stop bits, seven or eight character word length, using COM1 or COM2 serial ports, and with optional screen output. An 8k buffer stores incoming data.

It is a simple enough program. Enter enters remote mode. Pressing P dumps a screen to a printer. F1 and F2 exit, F1 without hanging up, while F10 sends a break code. It is limited in its capabilities, and a proper data communications package would be advised for serious data communications.

Compatibility

No problems were encountered with software compatibility and the Sotec/Datavue happily ran the commercial software tested.

Public domain software sometimes displays little quirks when run on compatibles, so see the program running before you choose.

Documentation

One manual and an addendum came with the review machine. The particular features of the machine are explained, but DOS is glossed over very superficially. The distributor says that a proper DOS manual is being produced in Taiwan.

The main manual is written for an LCD display machine with a 5.25in disk drive.

That's not the machine reviewed, but it is relatively simple to make the translation, provided you ignore references to batteries.

Getting up and running is the first priority of the manual, and it repeats the procedure twice. Then there is a Mickey Mouse guide to how a computer works ("Your body is like a computer system..."). Next comes a guide to the setting options available on the computer, and how to use the dip switches.

A few more pages detail keyboard commands to alter the display, and how to use the two applications built into the machine. There's some advice on how to transport the computer, and a short chapter on DOS that covers the FORMAT, DIR, DISKCOPY, COPY ERASE and TYPE commands and how to make a backup DOS.

A chapter is devoted to how to perform diagnostics, and then it is on to the available peripherals. There is also a modestly detailed chapter on the technical side of the computer, with a memory map, using the CMOS RAM, managing memory RAM, display options, and addenda with port pin charts, the ASCII character set and a glossary of terms.

The addendum to the manual is short, and covers the features of models with a hard disk drive, or two 3.5in disk drives. So, to make the most of the machine, you'll need a DOS manual at the very least. The rest is fairly straightforward.

Prices

The Sotec/Datavue costs \$6300 which includes a gas plasma display, 1.2Mbytes RAM, one 3.5in disk drive and a 20Mbytes hard disk.

A system with 1Mbyte RAM, one

5.25in floppy disk drive and an LCD costs \$3400. The same system with a gas plasma display costs \$4100.

Optional extras include a second 5.25in disk drive \$650 and an expansion unit (which can accommodate three expansion boards) \$1300.

Conclusion

Reviewing the Sotec/Datavue is more like reviewing a desktop than a portable, so laden is it with features. It is an intriguing little computer, and a powerful one at that.

Its appeal is curious. For a start, most of us wish our desktops didn't take up quite so much room. The Sotec/Datavue is an answer to that wish. It also answers the needs of those who need to move our micros around frequently, say from home to work, or from office to office.

However, it lacks the true portability of the other three computers in this section, and can't be used away from the mains. It is also a pricey beast, by comparison to the others, though it contains far more technology.

As such, it might be a better bet than a true portable. After all, how many times do you want to use your computer out in Woop Woop, away from 240 volts? Most hotel rooms and offices have power sockets, and with the Sotec/Datavue you are not compromising power for portability.

It might even make a sensible alternative to the conventional desktop, if you are the sort of user who only needs to compute for a short time each day, and doesn't want a desk clogged up with bits of a micro.

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Toshiba T2100

If you put together a list of the computer companies who could justify saying they were a household word, you'd probably end up with a list of one—IBM. You might stretch the list to include Apple and Commodore, but that's about as far as it goes. But, if you look to Japan, you'll find a number of consumer electronics companies getting in on the computer act with a vengeance. Sony, Sharp and Toshiba have all moved in to the personal computer market. It is Toshiba's laptop PC lookalike that concerns us here.

In the marketing of computers, it is a definite advantage to have a well known name. A customer is as likely as not to know anything about computers, and if your machine has the same brand as his television and Hi-Fi, you start with a competitive edge.

However, a good name doesn't necessarily make a good computer. Toshiba knows that as well as anyone, and the T series of laptops would cause consternation among the competition even if it were branded Mickey Mouse.

There are two computers in the range. The T2100, reviewed here and priced at \$4250, is the entry level model. It is a souped up PC clone, with a gas plasma display and two 3.5in disk drives. It is available with a hard disk drive too, for \$6500. Completing the range is the AT-compatible T3100, costing around \$8500 with 10Mbytes hard disk.

Hardware

First impressions created by the T2100 are impressive. It comes in a smart, grey, nylon case, with enough room to carry the three manuals, the power cord and some 3.5in disks. It can be hand held or slung over the shoulder too, for maximum portability.

The T2100 itself has a substantial carry handle that slides out from the case and can be coaxed through 90 degrees to act as a leg. This raises the back of the casing up a few centimetres, improving the angle of the keyboard.

The casing itself is finished in stylish gunmetal grey, with an orange logo and cooling grilles at strategic locations. It has a hi-tech air about it that is hard to ignore. Compare that to the anonymous beige box of the IBM Convertible.

Dimensions are on the modest side. The T2100 measures 31cm x 8cm x

36cm and weighs 6.1 kg. It won't quite fit in a briefcase, but it is not designed for that.

Nor is it designed to operate away from the mains. Unlike most portables, the T2100 is not battery powered. It needs a healthy 240 volts to run the gas plasma display, and the hard disk if that is fitted. Now many portable users supposedly buy their computers so they can compute in an aeroplane or in their car. If that's you, forget the Toshiba right now.

But, if you see a portable as a machine you can easily carry as hand luggage, to use in a hotel or at another office, or if you like to bring your work home with you, the mains limitation is hardly of concern, especially when you look at the other features of the Toshiba. Think of it, not as a laptop, but as a truly portable computer.

Ports are restricted to the back of the machine, and there is quite an array. A disk drive is found at each side of the machine.

Pushing in a catch at the front lets the display-bearing lid flip up. The screen is

19.5cm x 14.5cm in area. Closing the lid switches off the display, but does not turn power off. You can therefore leave the T2100 switched on all day, and just raise the lid when you need to get at it.

The display tilts back to about 135 degrees. It has no click-stopped settings, but is hinged firmly enough to stay where you put it. There are a number of function lights beneath the display, indicating power on, CPU speed, disk drive/s in use, Caps, Num and Scroll lock.

Power on brings up the bright orange of the gas plasma display, a memory check of the 256k standard RAM, a beep and the loading of MS-DOS 2.11. There is the usual prompt for time and date, but an internal clock keeps track of that.

Excellent is an apt description of the display. The easiest way to see what it is capable of, is to run the demo program supplied on the system disk. This gives a demonstration of the minimal sound capabilities of a PC, an overview of what spreadsheets and word processors are all about, a screen of system



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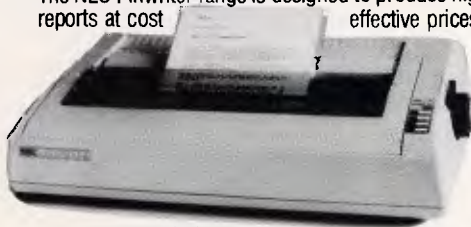
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specifications, a simple game, and, most impressively, graphic images depicting foreign cities and some graphics routines that show the clarity and speed of gas plasma in action, helped along by a high speed processor.

OK, so gas plasma needs mains, and costs more than liquid crystal, but there is no need to worry about backlighting it in low light, and no need to worry about the right viewing angle to make out characters, there is more rapid screen refreshing and it makes LCD look like yesterday's technology. The only advantage to LCD is that it makes for a truly portable computer.

The keyboard has 81 keys, with the usual arrangement of the numeric keypad overlaying a section of the alphabetic keys. There are four cursor control keys, and separate keys for page up and down, home and end. The layout is fairly conventional, with function keys along the top of the keyboard.

Alphanumeric keys are in a brown grey, to differentiate them from the control keys. All are clearly marked and there is a removable sheet of plastic on which function key actions could be written. The keys are sculpted, have a positive feel to them, and make word processing a pleasure. Touch typists won't find the keyboard big enough, but that is a complaint that can be levelled at any portable computer.

The ports along the back give scope for an external RGB or composite video monitor, an external disk drive or a parallel printer and an RS232 device. Internally, there is 256k of RAM, expandable to 640k, and space for either a proprietary expansion card or a modem card.

So, on a first glance, the T2100 has a lot going for it.

Eight screws hold the top section of the casing on to the base. Removing it entirely is hampered by the large number of wires running to and from the gas plasma display. Still, the keyboard lifts out easily enough, to reveal much of the innards of the Toshiba.

The two 3.5in disk drives are back to back across the main casing, covering one of the two PCBs. At the rear, and hidden by a large, metal heat sink, is the power supply unit and the rear of the various ports. A fan outputs hot air through the back of the computer, and runs with a muted and barely noticeable whirr. There is no overheating during operation.

With all this lot, there is not much space for other things. To fit a hard disk drive, the left hand 3.5in disk drive is removed, and there is space under the power supply section to slot in a half length expansion cord.

Towards the front, there is a clear view of the main PCB. Toshiba has labelled the major components clearly, perhaps to help reviewers. There are two vacant chip receptacles. Next to the CPU is one for an 8087 maths coprocessor, should you need extra number crunching capability.

The other is labelled second ROM. In the manuals, there is no mention of what this is for, but it does mean that there might be some extra goodies for the T2100 at a later stage. It also means that a customer specific ROM could be blown, giving on-board applications and customisation. An insurance company, for instance, might want to install software that calculates premiums and the like, for use by agents in the field. It is forward thinking on the part of Toshiba.

The CPU is not the one you normally find in laptops. It is a 16-bit Intel 8086, and it is not a CMOS chip. That's one of the advantages of opting out of the battery powered route.

What's it do? Well, it speeds everything up. 8088 chips trundle along at 4.77MHz, but the 8086, perfectly compatible in every way, runs at 7.16MHz. It is like having a turbo-charged PC. A look at the benchmarks will confirm the magnitude of the speed increase — the T2100 runs roughly twice as fast as other laptops fitted with an 80C88 processor.

Some software won't run at this speed, and Toshiba has thought of that. The 8086 can be switched from the keyboard to run at 4.77MHz. The power light switches from green to red to indicate the slower CPU speed.

The main PCB holds the eight 32k RAM chips. A space alongside them is space for the insertion of an additional 384k RAM memory card, costing \$657. Installation could be done by a user, but isn't recommended by the manual.

The important chips are all Toshiba's own work. These include the bus driver and controller ICs, and the 32k ROM. The main PCB also has an array of six dip switches (for dictating hardware

options installed), and a small speaker connected to it, sounding out through the base. It is uncluttered, well laid out and hasn't just been cobbled together from any components that could be bought. Toshiba has designed the T2100 from the PCB out.

The expansion potential of the Toshiba is significant. We've already mentioned that internally an 8087 maths coprocessor, and a second ROM can be added. A 10Mbytes hard disk is also available, replacing one of the 720k 3.5in disk drives, and RAM can be upped to 640k by the addition of a 384k memory expansion.

Along the back, there is an array of other expansion devices. At the top, there is a standard power socket and an on/off switch. There is also a voltage selector, with a small plate covering the 115 volt setting, so the switch isn't moved accidentally. It is handy to know that you could go to a 115 volt country and use the Toshiba without trouble.

Should you want a bigger display, or to show colour, there are outputs for both composite video and RGB. Pressing a chord of three keys turns off the gas plasma display. The RGB output has a standard nine pin socket.

The RS232 socket is also a nine-pinned device, and that is not quite as standard as some would like. Next to it is a 25-pin parallel Centronics port, used for either a printer or an external 5.25in disk drive, costing \$868.

Benchmarks

BM1	0.9
BM2	2.8
BM3	5.7
BM4	5.8
BM5	6.6
BM6	12.0
BM7	18.4
BM8	17.4
Average	8.7

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	8086 running at 7.16 or 4.77MHz
RAM:	256k
ROM:	32k
Keyboard:	81 full-stroke keys
Display:	80 x 25 gas plasma screen
Weight:	6.1kg
Dimensions:	31.1cm x 8cm x 36cm
I/O:	Parallel printer, RS-232C serial port, RGB monitor, CV port, one expansion slot
Mass storage:	Two 3.5in 720k disk drives
DOS:	MS-DOS 2.11

PORTABLE PCs

To determine how the port will be recognised, there is a three setting switch on the left of the main casing. Set to PRT, the parallel port drives a printer, and the two internal drives are A and B. Set the switch to either A or B and the Toshiba will recognise an external disk drive connected to the parallel port, ignoring one of the two internal disk drives. You cannot run two internal 3.5in disks and an external disk, though with an internal hard disk, three drives will be recognised.

The last expansion port is a slot covered by a plate. This takes either a modem card or an expansion card. The modem card costs \$720, and runs at 300 or 1200 Baud. It has tone and pulse dialling capability. Less is known about the expansion card. Additionally, an interface card can be inserted in place of the modem, and an expansion box can be connected to that. The expansion box holds five full length PC cards.

System software

There is little supplied in the way of software with the T2100. One system disk comes with the unit, and this is a fairly standard disk.

It contains the usual combination of MS-DOS 2.11 and GW Basic. The only addition is an application called Chad. This sets the screen colour attributes. Install it, and then push a key labelled Sys Req to bring up a window showing the display attributes. The settings are normal, reverse and intense, on colour or black background. Attributes can also be set from the command line. It enables the display to be set up to give the best simulated colour display.

For text display, there are two options. Characters can be displayed with single or double dot intensity, the switch being made by pressing ctrl, alt and right hand cursor keys simultaneously. Double dot density makes for a more pleasant display.

Test is a diagnostic application that checks the display, disk drives and system memory. It is fully documented. Demo is the demonstration program mentioned above.

Compatibility

Being a PC clone, the Toshiba should run just about anything that will run on a PC. As mentioned earlier, the CPU can be slowed down to cope with applications that need the 4.77MHz speed. Certainly the applications I tried ran without trouble and benefitted greatly from the faster CPU speed.

The only problem might be getting

software formatted on a 3.5in disk. There is a growing amount of this, but your best bet might be to either get the external disk drive, or write a simple data communication program and port files across from another computer.

Documentation

Toshiba supplies three manuals with the T2100. The owner's manual is the key documentation.

It kicks off by describing the main features of the computer, and running through some of the peripherals available for it. Then there is a chapter for the paranoid about precautions to be observed when using the T2100 (such as a warning not to try debugging by spraying insecticide on the casing!)

Setting up comes next, with a description of how to connect peripherals and switch on. Operation is the most useful chapter, as it describes how to use the keyboard, initialise the system and so on. A longish chapter then runs over the basics of MS-DOS, and that is followed by a detailed description of the diagnostic program, and how to correct problems. Finally, there is a chapter dealing with the peripherals available, and how to install some of them. You get the feeling Toshiba wants you to buy peripherals from all this!

What is missing is detailed technical information of the I/O ports, memory maps and ROM routines. There is not even an ASCII chart in the owner manual.

You'll find that the MS-DOS manual, won't hold together long unless it is put in a ring binder. It is a Japanese copy of the standard Microsoft manual, with more than a fair smattering of typos and no attempt to brighten it up. Much the

same applies to the Basic manual. Again, it needs to be ringbound to survive reading, and it is a copy of the Microsoft manual.

Prices

The Toshiba 2100 sells for \$4250 and includes a gas plasma display, 256k RAM and two 3.5in disk drives. A hard disk configuration costs \$6500.

Optional extras include an additional 384k RAM \$657; an external 5.25in disk drive \$868 and a modem card \$720.

Conclusion

On paper, the Toshiba has plenty to offer. It has an excellent gas plasma display. It has a faster than normal CPU, a good array of ports and plenty of expansion potential. It is also quite good value for money, given its specifications.

The main drawback is that it is mains powered, thus restricting its portability. Toshiba has also gone for hardware sophistication, rather than software overkill. This is a mixed blessing. It would be great to acquire a portable with a suite of simple software, particularly if it is a first time purchase. As it is, you'll need to spend quite a few dollars on the applications you need, or find a way to get them onto 3.5in disks.

As a second PC, to use away from the desk, the T2100 is practically unbeatable for its price. As a primary PC, seeing both the T2100 and a desktop micro need mains power, you might be better off looking at a conventional three box PC clone at half the price of the Toshiba. But, if you like your computers small and sophisticated, the Toshiba has a lot going for it.



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IBM Convertible

Lapheld IBM clones have been around for a good two years now, and it is a section of the market in which IBM has been conspicuous by its absence. Now it has rectified that situation, with its own lapheld PC, the Convertible.

Companies such as Data General, Hewlett-Packard, Zenith and Kaypro are well established in the lapheld market—in fact, they've created the market. There are also scores of Japanese, Taiwanese, Hong Kong-ese and other models around. So, IBM could have taken two tacks. It could have released a machine that was so dramatically different, possibly with an enhanced operating system, and with all sorts of goodies, and blown the opposition out of the water. Or, it could have looked at what's around, and then brought out a quality laptop that epitomised what IBM was all about, yet didn't risk sailing uncharted waters.

Rumours of the portable IBM, dubbed the Clamshell before its release, spawned much opinionating. When it arrived, in the middle of 1986, it proved that IBM had conservatively followed the second of the two approaches above, and pundits went back to talking about IBM and 386 technology. In fact, the new IBM was not special enough to knock off Zenith for a \$US28 million contract with the American Internal Revenue Service.

In Australia, the IBM Convertible is priced at \$4106. With most of the rivals priced at well under \$4000, it's clear the IBM people have some work to do to get people to spend extra bucks on an IBM nameplate.

The Convertible is, you see, hardly a laptop to get excited about, apart from the IBM name on the front. It's good, has some clever features, but is still quite an expensive machine for what it offers.

Hardware

IBM has sized the Convertible to be one of the bulkier laptops, with dimensions of 35.5cm x 7.6cm x 48.3cm. That makes it a little too big to fit the average

briefcase, and in recognition of that fact, there is a sturdy, retracting carry handle along the top. The weight of 5.4kg makes the Convertible a middleweight in the lapheld contest.

The case is standard IBM beige, with the IBM logo on top of the screen section. Other than that, it is completely anonymous, as there is just an AC adaptor socket and a reset button to break the monotony of the case.

Like all portables, the Convertible runs from its own batteries. The battery is housed in the rear of the machine, and can be quickly removed for servicing. A full battery provides around six to 10 hours running, depending on how much the two 720k 3.5in disk drives are used.

Three audible beeps warn you that you'd better start recharging soon, and repeat the signal every two minutes if you keep computing. You can set the system to turn off either the display or all power after a pre-determined time. The

Convertible can also be run directly from the mains, with the supplied adaptor.

Two small catches hold the screen down, and opening it without standing the Convertible up is not easy. When the screen is raised, power comes on automatically, and it is down to business.

The screen is a standard 80 x 25 LCD display. It is non-backlit, which is poor for a laptop of this price, but has variable contrast. It can be angled back to about 30 degrees beyond the vertical.

As with most LCD displays, visibility is not a strong point. The IBM display is better than that of many others, but in low light, you'll wish you had backlighting.

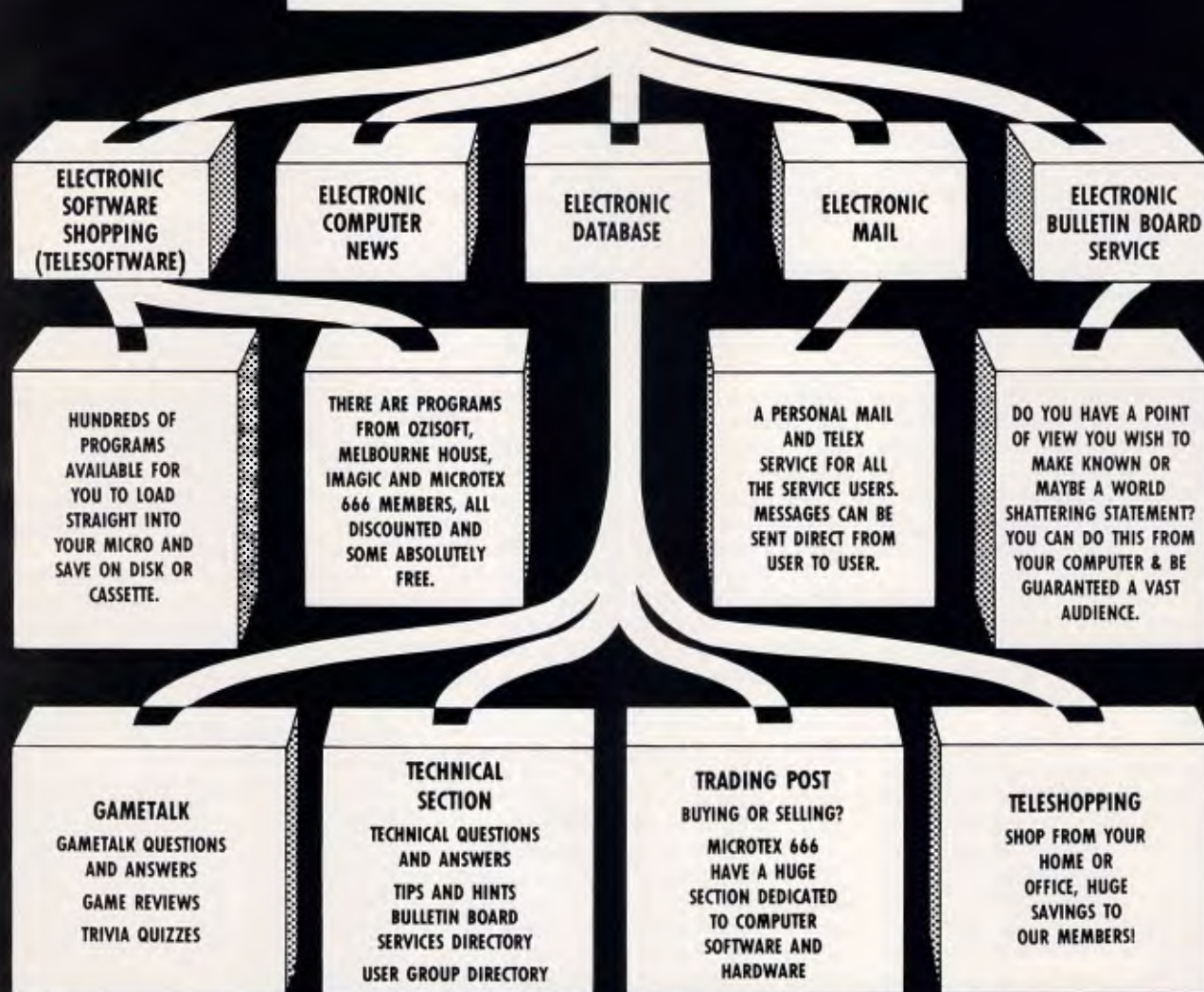
However, IBM has a solution of kinds to the problem. The screen can be removed from the computer and, in its place, a cable fitted that lets the Convertible use a conventional monitor, or a nifty little 9cm mono monitor launched at the same time as the Convertible. Many



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PORTABLE PCs

other laptops allow the use of a monitor, but none have yet come up with a removable screen.

Raising the screen also rather cleverly raises the top rear of the machine, to lift the twin 3.5in disk drives into view. Each has a yellow light to indicate disk drive operation. Having the drives above the keyboard gives the best access, and is a very sensible arrangement.

The keyboard has 78 keys, duplicating all those found on a standard IBM PC, with some doubling up of functions. The function keys are arrayed along the top of the keyboard. There is a separate cursor keypad, for instance, but the numeric keypad is overlaid on the alphabetic keypad. That's typical of a laptop, and a constraint imposed by price.

Raising the screen tilts the keyboard up to a usable angle. The keys have a quality feel to them, a long-ish travel, and feel solid. IBM has certainly delivered the goods when it comes to keyboard design. There is only one expansion port on the Convertible, though there are quite a few options available for it. These include a thermal printer, an external disk drive and a serial/parallel adaptor. An internal modem is also available in the US. Basically, with the Convertible, you buy the basic box, and then add the extras when you can afford them.

The Convertible is supplied with PC-DOS 3.2 and an Applications Selector disk that gives an icon interface to DOS. We'll look at that later. There is also a pair of manuals, on DOS and on the Convertible.

Getting the Convertible apart is no easy task. Four screws hold the backplate on, and the LCD screen slides out easily. A small PCB running along the back of the computer is slid out too. From there, the front of the keyboard must be prised out with a screwdriver, two ribbon cables disconnected, and the upper section, holding the disk drives, lifted back out of the way.

Inside, on the base, there are two main PCBs. They are full, and mainly with large, sophisticated chips. Here is what you are spending your money on.

The main processor is a CMOS version of the Intel 8088, the 80C88, running at the standard speed of 4.77MHz. There are two banks of 128k RAM, giving a total RAM of 256k. There is space for two more such cards, costing \$396 each, upping the total memory to a respectable 512k. The RAM cards lie underneath the keyboard.

The real technology resides in four large, square, IBM branded CMOS chips. These are gate array chips, meaning that they are made initially with unlinked transistors. They are connected according to a chip design, by depositing interconnec-

tion wires on the chip. It saves time and money when designing a chip. The four gate arrays each hold 8,400 circuits and over 39,000 transistors. They control the keyboard, display, RAM and disk drives, yet consume just 0.25 watts of power.

IBM also makes extensive use of surface mounting technology in the Convertible, obviating the need to have holes drilled in the PCB for chip pins. It saves space on the PCB too.

So, inside the Convertible, things are neat, uncluttered and of a very high quality. All the capacitors and other bulky items are on a small PCB at the rear of the machine. There is virtually no metal, other than on the disk drive components, yet the unit does not run hot.

There is not much room for expansion inside, barring the memory expansion. There is a plug for an internal modem, but there is no 8087 maths co-processor socket, and certainly no room for standard expansion cards. To cut things short, there is one port on the Convertible. However, there is a small, and expensive, array of options available.

The most attractive is a dot matrix or thermal printer designed to clip on the back of the Convertible and priced at \$633. It runs at a modest 40 characters per second, but can handle graphics, has variable density and adds only a few centimetres to the size of the Convertible. A printer cable for the IBM printer costs \$95.

Inside, you might be able to install an IBM modem, if it gets Telecom approval and is released. In the US, the internal modem runs at 110,300 or 1200 Baud, using an 8250A asynch controller.

If you want to use an external modem, or a standard serial printer, you'll need to add a serial/parallel adaptor to the Convertible. It costs \$401, and is essential if you want to communicate with the outside world using the portable IBM. IBM has certainly got a captive market with this product, as the expansion port on the back of the Convertible will only take IBM products.

Extending display options involves buying an IBM CRT Display Adaptor, costing a mere \$665. It also clips on the back of the Convertible system unit, and can run mono or colour displays.

Finally, you can add a third 3.5in disk drive, for a cost of \$822. At this stage, there is no way to add expansion cards, hard disk or 5.25in disk drives to the Convertible. Expansion, though possible, is therefore costly and limited in a number of ways. The Convertible is almost a closed system, and anybody buying it will have to live with IBM products alone, while jealously eyeing owners of other laptops who seem able to add any sort of accessory they see to their systems.

System software

If we are negative about expansion, we can be nothing but positive about the software. It comes on two disks — a start-up disk, and a disk with PC-DOS 3.2 and GW Basic.

On power-up, the Convertible initially does a memory check, and gives audible or visual warnings if there are problems. You can go through this procedure at any time with a few key presses to reset the system, and there is a full diagnostic application supplied too.

The first display is a clock to show the time needs to be reset, followed by prompts to insert a system disk. If you fail to do this, the system reverts to cassette Basic, which has no program storage

Benchmarks

BM1	1.5
BM2	5.0
BM3	11.6
BM4	12.0
BM5	12.9
BM6	22.4
BM7	35.6
BM8	34.1
Average	16.9

All timings in seconds.

For a Benchmark comparison of all systems reviewed see page 8.

Technical specifications

Processor:	80C88 running at 4.77MHz
RAM:	256k
ROM:	64k
Keyboard:	78 full-stroke keys
Display:	80 x 25 LCD screen
Weight:	5.4kg
Dimensions:	35.5cm x 7.6cm x 48.3cm
I/O:	Expansion port
Mass storage:	Two 3.5in 720k disk drives
DOS:	PC-DOS 3.2

PORTABLE PCs

commands. The start-up disk contains a comprehensive guide to the features of the Convertible and the software supplied with it. It assumes no knowledge on the part of the user, and guides the newcomer through the keyboard, the features of the Convertible and how to use the applications supplied with the machine.

With the start-up disk, you create a SystemApps disk. This contains the applications provided with the Convertible (Tools, Notewriter, Schedule, Phone List and Calculator), and, at your discretion, a merged version of DOS. You can also customise the Convertible, setting the time and date, the display, what your system consists of, whether to start at where you last left off when power was turned off, or not, and other options.

The interface with SystemApps is an icon type. The screen displays two screens of 10 application or disk icons, of which 13 can be user defined. Applications are booted with the press of a function key. You can also interrupt any application and return to the icon window by pressing Fn and Esc keys.

There are five applications supplied and all can be accessed from within another application. Tools enables you to change the system profile, reprogram

function keys, copy and erase files, see a directory, copy or format a disk and print a file — all the major DOS commands — without knowing the intricacies of DOS. Help is available at any time. For an inexperienced DOS user, Tools is a real asset.

Notewriter is a simple word processor, with function keys driving it. Text can be loaded and saved, blocks of copy moved, copied or deleted, paragraphs and margins reset, and text printed out.

Schedule is, as you might expect, an electronic diary. It displays a day, a week or a month. Up to 32 alarms, signalled by the Convertible's internal speaker, can be set, as well as a symbols to remind you of special days: A To Do list can be created on a day display, and, of course, there is help on tap at the press of a key.

Phone List holds names, addresses and phone numbers. With an internal modem, it will also dial telephone numbers too. Numerous directories can be created and loaded one at a time. Entries are automatically alphabetised, and there is a search function to find a particular entry. Directories can be printed out too.

The Calculator automatically engages the numeric section of the keyboard, and changes the function keys to act as

mathematical function keys, or affect the calculator memory. A 'tape' on the screen records calculations, and this record can be printed out.

The collection of applications is just what the travelling Convertible user might need, and their implementation is excellent. It is almost as good as having Borland Sidekick installed.

DOS 3.2 adds 15 new commands to DOS 2.0. They include ATTRIB, JOIN, LABEL, PROMPT, REPLACE, SELECT, SHARE and XCOPY. Yes, the new DOS is an improvement on the old, but anyone used to the old will have no problems coping with 3.2. You also have Basic and Advanced Basic supplied.

Compatibility

As for other software, it goes without saying that the Convertible will run anything its desktop relations will, providing it is available on 3.5in diskette. We ran Microsoft Word, Chart, Multiplan and Micropro's WordStar 2000, with no problems. The best way to convert 5.25in software would be to add a 3.5in drive to your desktop, and copy it over for use in the Convertible.

Documentation

Two manuals come with the Convertible.

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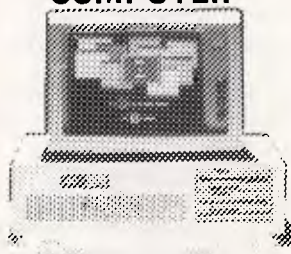
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PORTABLE PCs

The ring bound Guide To Operations gets newcomers up and using the portable, explains the applications and the hardware, including the peripherals, has a large section on diagnostics and troubleshooting and has appendices detailing ASCII character codes, printer control codes and error messages. It is detailed, well presented, and up to IBM's usual high standards.

The DOS manual contains a DOS primer and covers the major commands. It is colourful, logical and clear – an excellent introduction to the subject. A reference card details all the DOS commands, though most of these are left unexplained. The manual will get you up and walking with DOS, but to run, you'll need more assistance.

Basic is on the DOS disk, but you'll find no documentation on that subject. That's a bit of an oversight, considering the

Convertible defaults to Basic if no system disk is installed at initial power-up.

Prices

The IBM Convertible costs \$4106 and includes 256k RAM, two 3.5in disk drives and an 80 x 25 LCD.

Extras include a 128k RAM card \$396; dot matrix printer \$633, (and you'll need the printer cable \$95); serial/parallel adaptor \$401; an IBM CRT Display Adaptor \$665 and a third 3.5in disk drive \$822.

Conclusion

The IBM Convertible is a machine to love and to hate. You love it because it is an IBM, because it has a real quality feel about it, has excellent documentation, DOS 3.2 and a great suite of simple to

use applications supplied with it.

You hate it because, in its base form, it lacks so much. For a \$4000 plus laptop not to have a backlit LCD display, not to have a standard printer or RS-232 port, not to have some means to connect expansion cards and not to have monitor connections is more than a little disappointing. When you realise that to get all this you'll have to spend at least an extra \$1000, you start to wonder whether the Convertible is really worth it.

It is a bit of a Rolls Royce syndrome. The Convertible is good, very good, but it is also very expensive for what it offers. Less expensive laptops will do almost the same, and more in some areas. Still, the Big Blue logo will probably sway the minds of those who care less for dollars than image.

SUMMARY

The four portable computers reviewed epitomise the huge range of choices available within the field, and that is without considering the non MS-DOS machines available.

Each computer has basic strengths and weaknesses, and would suit a certain type of buyer. As is always the case, there is no perfect computer, portable or otherwise. That's what makes the market so interesting.

Before recapping on each model, let's review what the ideal is. Laptop or portable computers should be small enough to go anywhere, yet powerful enough to carry out most of the tasks of a desktop PC. They should be expandable to accommodate extra storage, modems and standard display options. You can expect them to cost more than a desktop micro – how much more depends on the features in the computer. And they should be able to run a wide range of software, with no impact on performance.

The Bondwell 8's chief virtue is its low price, \$2450, and what is included in that price. It comes complete with a good array of ports, 512k RAM and is one of the smallest laptop PCs in the business. On the minus side, it has no internal expansion potential, and a mediocre liquid crystal display.

The IBM Convertible's best features are the name and the software supplied with it. Application Selector, with the icon interface to PC-DOS, and the useful applications within it, is all the user would need for basic computing. The Convertible is well designed, and has a

good system behind it. Unfortunately, to expand it involves spending a considerable amount of extra money, and the non-backlit LCD is a hangover from laptops of two years ago. It is also a very expensive machine for what it offers, but that is traditional for an IBM product.

The Toshiba T2100 costs only a little more, in its basic form, yet has the considerable advantage of a gas plasma display, a fast CPU to speed up software and all the ports you need to plug in a few peripherals. It is well designed too and has plenty of expansion potential. On the debit side, the Toshiba needs mains power to run.

Finally, the Sotec/Davavue offers superb specifications. The gas plasma display, built-in 20Mbytes hard disk, 1024k RAM and infra-red keyboard are all worthwhile features. There is a good deal of expansion possible too. The other side of the coin is the size of the computer and the fact that it needs mains power, thus taking it out of the truly portable camp.

The four computers then fall into two types. On the one hand, there is the LCD group of the Bondwell and the IBM. These are portable, but the displays leave something to be desired. The backlighting of the Bondwell is a definite advantage.

The gas plasma computers have far better displays, but are not so portable. Admittedly, all four computers can run an external monitor, but this will restrict them to a desktop, and if they are being used predominantly with an external monitor, a true desktop micro is worth considering. Both LCD and plasma dis-

plays are not ideal for colour, though they can handle it.

Before buying one of this quartet, ask yourself if you really need portability. Sure, it is a good concept, but the sacrifices you make in display quality, keyboard size and expansion may outweigh the size and portability aspects. A portable is really only of benefit if you are either a user who needs occasional access to an MS-DOS machine, and doesn't want a desktop taking up valuable desk space, or a user who needs to cart a computer from location to location.

If you decide a portable is the way to go, ask yourself whether you need to have battery power. If you will be using the machine near mains power, the advantages of battery power will be minimal.

Also ask yourself how much memory you need. If your portable is to be your main computer, a hard disk is a feature worth having. However, if you don't have much data to store, or few applications to run, it may be a luxury you can do without.

In summary then, the Bondwell represents the best value for the user after a good, mains independent laptop computer. The Convertible is a quality laptop with a good front end, but it is pricey.

The Toshiba is state of the art, and all most portable computer users could wish for, at an affordable price. Finally, the Sotec/Davavue is a portable powerhouse that offers plenty for the money, but is rather bulky. It is a desktop equivalent, in all but size.



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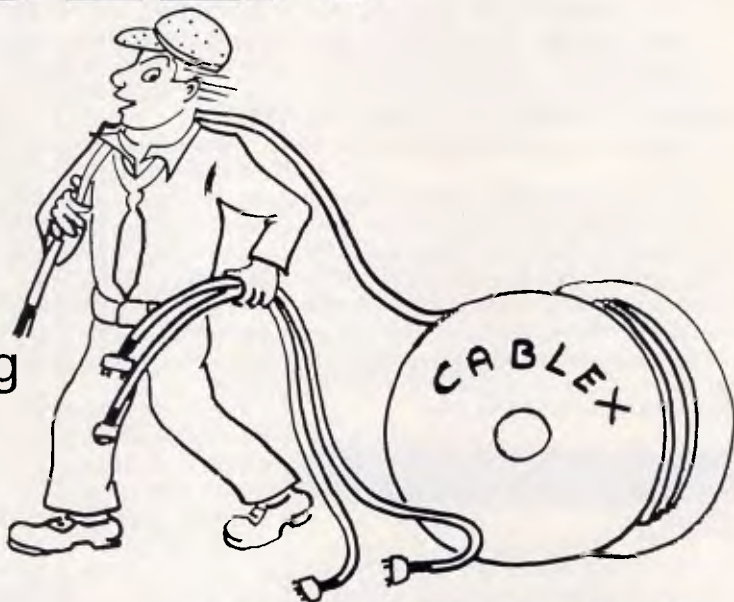
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But while there are some things you can clearly manage without in the early days, don't go to the other extreme and hug your wallet so tightly that you find yourself running out of mundane essentials — the bread and butter of computer housekeeping.

These bread-and-butter items, such as printer ribbons and diskettes, are known in the trade as consumables (as distinct from peripherals and accessories which you can possibly live without), and curiously enough, they are the very things most new users do forget about until the last minute, and then dash out and buy in a hand-to-mouth way, which is against all the golden rules of economy.

So even if you prefer your finances to build up a little, after you've bought your PC, use this time to plan ahead and avoid paying more than you should for these rather unexciting necessities. That way, you just might be able to lash out later on something you really feel passionate about, such as an ergonomic modular workstation or a Balans chair.

What you need

Disks

If you're being conscientious about your disk security, back-up precautions alone will mean new supplies. It may also mean you're paying more than you should if you are too timid to shop around and investigate brands other than the ones you got in your starter pack.

A box of ten standard IBM-type disks,

doubled-sided, double-density and 40 track, should be costing you somewhere between \$35 and \$40, depending on the quantity you buy. If you want something a bit less top-notch, but still guaranteed, there are imported Xidex precision disks for \$20-\$30 for a ten pack. (The more expensive Xidex are manufactured in Sydney, if patriotism is a big issue).

It always pays to browse through the small ads in your favourite computer publication, where you will find companies specialising in just one line of consumables. Independent Software Duplication, of Westmead, Sydney, found it had built up a good clientele with its duplication business, so about one year ago it branched into supplying blank disks.

"We were getting a good deal from our supplier because we bought in bulk so we decided to sell to the public," says production supervisor Mark McDonald.

For a \$6 courier fee, Independent Software Duplication will deliver overnight to any place on the eastern seaboard, with South and West Australian orders costing a few dollars more.

Prices range from \$8 or \$9 for a single 5in floppy, which McDonald thinks is a couple of dollars under what you'd pay in plenty of other places.

Overall, the disk market is volatile, with prices going up and down like yo-yos. A cheap one may be fine, depending what you use it for. Tales of people buying marvellous bargains in the East and then finding they don't work are not uncommon.

Disks seem to figure in a lot of crisis scenarios, but as suppliers point out, for many people it's out of sight, out of mind,

with disks, unlike letterhead stationery and envelopes which can be seen to be dwindling. Also, disks bring out the worst in the sort of person who can't bear to throw anything away in case it's needed in ten years' time.

However, physically the disks are very much in sight, and often in greasy hands as well. Disks (and PCs) respond badly to having cigarette ash and coffee dropped on them, which means in the average office the sooner you get a disk-head cleaning kit the better. At Computer Office Supplies these sell for between \$16 and \$17, including the long-awaited kit for cleaning the 5in Apple Macintosh disk. A couple of dabs once a week is sufficient, and means one kit should last about four months. Other suppliers think once a month might be sufficient.

This is known as the wet cleaning process. There is also a dry cleaning process like that used with stereo cassettes.

Because disks breed like wire coathangers, it is essential to buy a storage box. The lockable sort is strongly recommended, and should not cost above \$30 for the smallest sort, capable of holding 50 disks.

Paper

Paper is another thing users seem to take for granted. At Computer Print and Paper Company, of Cheltenham, Victoria, marketing manager, Mike Clotworthy warns that some grades will not go on certain printers and therefore it's better to get good quality paper because it's also possible that cheaper paper will leave more dust residue in the printer. Computer Print and Paper obtain

CONSUMABLES

supplies locally, mainly from Australian Paper Mills, and find that not all imported paper is necessarily good.

It is difficult to give prices for fanfolded paper but be prepared to find that in small quantities, continuous letterhead, invoices, and statements, etc, could cost more than you think, because this is a trickier process. Naturally the price depends on the quality of the paper and the complexity of the logo but you can expect to pay about \$30 or so for a fairly basic order of 1000 sheets.

Because fanfold paper is fed into the printer on sprockets it tends to work more smoothly than separate sheets of paper which can shift about. You can get sheetfeeders but Clotworthy finds that they're not too popular and really need monitoring, though this will depend on your printer.

Before buying any paper, think carefully about formats and sizes, as

certain lines, such as 8.5in paper, tend to disappear. Otherwise you could wind up getting locked into one supplier who still does it your way, and he too may disappear.

A box of 2500 sheets of plain continuous paper might cost you \$40 to \$50 at Computer Office Supplies (that is, standard 11 x 9.5in paper for an 80 character printer). For a 132 character printer, a box of 2500 could cost up to \$60, depending on your choice of paper quality, and blue and white line markings.

Your paper mountains are also going to need filling, in special computer binders. These should cost around \$3 each for the polypropylene sort, which come in two sizes, 80 and 132 character, according to the printer.

For handy access you might consider a mobile storage trolley, a sort of box on wheels with castors, about 3 feet high,

which can store 12 to 15 binders.

Ribbons

Unfortunately, graduating from a typewriter to a computer is no escape from the recurring crises with ribbons, unless you have joined the still tiny minority of laser owners.

At the moment, dot matrix printers have more than 80 per cent of the market, and a standard nylon printer ribbon (for an 80 character column) should cost between \$10 and \$15, with a 132 character column type costing \$14 to \$20.

For daisywheel printers, multi-strike ribbons are priced between \$10 and \$20, and correctables up to \$20 but possibly as low as \$5 if you shop around.

Meanwhile a significant blow has been struck against the tyranny of the ribbon



by a Queensland pharmacist, Spiro Kouzaris and his wife Sandy, trading as Aussoft, and marketing a re-inking machine. Invented in 1980 by the aptly named Computer Friends company, of Oregon, USA, the re-inker is a 750gm device, the size of a city phone book which contains a felt roller which you douse with special ink before winding the ribbon on. At \$165, the re-inker keeps your ribbon in harness (provided it's the sort you can get out of the cartridge) until it starts to disintegrate.

Whatever you may think about the ever-increasing cost of ribbons, for both printers and typewriters, which are overwhelmingly imported from the US and Japan, they do not disintegrate. The Kouzaris' say what Australian-made ribbons there are have a pathetically short life. And at Rapid Ribbons, of Artarmon, Sydney, Albanian-born Esca Lluca says bluntly that they're cheap and nasty. "We don't understand the niceties of ink, or quality control," he claims.

Rapid Ribbons claims to be Australia's largest importer of ribbons (95 per cent from Japan, 5 per cent from the US), and has been supplying end users, other importers, manufacturers and retailers for the last four years, keeping over a million in stock. It specialises in speedy delivery within two days to anywhere in Australia (\$15 delivery fee for Townsville, \$4 for metropolitan Sydney).

Lluca claims there's a vast need for his services as "dealers are only interested in selling machines."

Clotworthy, though, says there are good Australian ribbons but the problem is cartridges. They're expensive and the Australian market isn't big enough for economies of scale. "The biggest problem with ribbons is the manufacturers," Clotworthy says. Ribbons are constantly being modified and changed so different ribbons fit different machines as time goes by, but there are certainly lots of cheaper compatibles about.

"The secret is to find a reliable supplier who can take care of as many of your needs as possible, to avoid dealing with half a dozen different suppliers," he says. You should then use your supplier as a friend and confidante, like a good GP.

Monitors

Glare is something you can hardly avoid noticing, but with computers it is amazing what people will put up with in the way of discomfort, as well as how often they neglect to make simple physical adjustments. So although screen filters are fairly modest, under

\$50, why not try turning the brightness down? It sounds obvious, but ergonomic experts are forever finding that hardly anyone bothers to adjust adjustable chairs. You could also try turning the desk around or re-positioning the desk lamp, or getting blinds.

The latest overseas tests have found that black on white is easiest on the eyes, just like good old paper, which goes against all we've been hearing in the last few years about the superiority of amber.

However, there is no denying that a screen filter will cut out some of the ultra-violet rays (very important if you're aware of the hazards of office lighting) and, because you don't need to have the



brightness turned up so high, it will take longer for your monitor tube to wear out.

Getting your monitor at the right level can lead you to think about monitor stands, which are available to tilt up, down and sideways for under \$50. However, if you are hankering for something major, you could try getting by with simpler expedients, such as placing a book under the front of the monitor, to raise it, or getting a lower/higher chair.

Optional extras

Remember with printers that the higher the speed, the more noise. Both daisywheel and dot matrix printers benefit from an acoustic hood, which will probably cost somewhere between \$500 and \$800. Computer Office Supplies supply hoods with two bi-directional fans to keep the printer cool, with its own internal power source which avoids a tangle of cables and cords. These hoods also have spring loaded hinges so they stay open at any height, leaving your hands (and head) free.

If you have heeded the recurring message from suppliers about finding a good all-round consumables person and telling him all your troubles, you just may have enough left out of your office

housekeeping to indulge in something really exciting.

It is recommended, incidentally, that you select one of your brighter office staff to be responsible for all this bread-and-butter stuff. It seems too many people are seeing the new PC as an extension of stationery, leaving it all to whoever has been buying the paperclips. Most suppliers feel computer consumables are far too important to be left to someone who doesn't understand computers, and to buy spasmodically from the first shop they see.

One such luxury might be a copy holder, to prevent one side of your neck growing imperceptibly longer from being turned to the left or right. There is now a type which sits at the back of the keyboard, without obscuring the monitor, which flips down when not in use to protect the keys from paperclips, ash and suchlike.

Ergonomic work stations, with height adjustable sections for your keyboard and niches for your disk drive unit, start at around \$500. If you want to impress people with your status, the traditional desk is still the best bet. If you really have status, you will not be spending much time in front of a computer anyway. But ergonomic furniture is popping up more and more among the binders and diskettes these days (competition in the consumables world is very keen), so be prepared to succumb to a designer range modular desk, built for the PC age, which will rarely be under \$1700.

And no matter what kind of desk you have, you'll need to pay particular attention to your chair. One of the less publicised contributions of the PC is that it has introduced Australia to Swedish-designed Balans chair — considered weird by anyone who hasn't used one, and raved about by anyone who has. Balans chairs are like sitting on slippers only with a support for your knees, thereby ensuring that your spine keeps its natural lumbar curve and preventing you from hunching forward over a protruding stomach.

Top-of-the-range Balans chairs which swivel and adjust cost upward of \$500, but Australian-made versions are available at places like the Bad Back Centre at Bondi Junction for much less, and provided you are the sole occupant, there is not much wrong with the strictly no-frills local variety, made in Wollongong and non-adjustable, costing \$80 in your suburban secondhand furniture shop.

By planning your purchases wisely with the more humdrum things, you might have enough left over for this kind of modest treat.

END



Ergonomically speaking

Ergonomic furniture for some people may be considered a luxury. But for the person working with a PC most of the day it's more a necessity. Graham Hardy explains why.

For the serious user of any type of computer, ergonomic furniture and the work environment are as important as the computer itself.

In fact some organisations, such as universities, won't approve the budget for new computer equipment unless it is accompanied by a budget for ergonomic furniture.

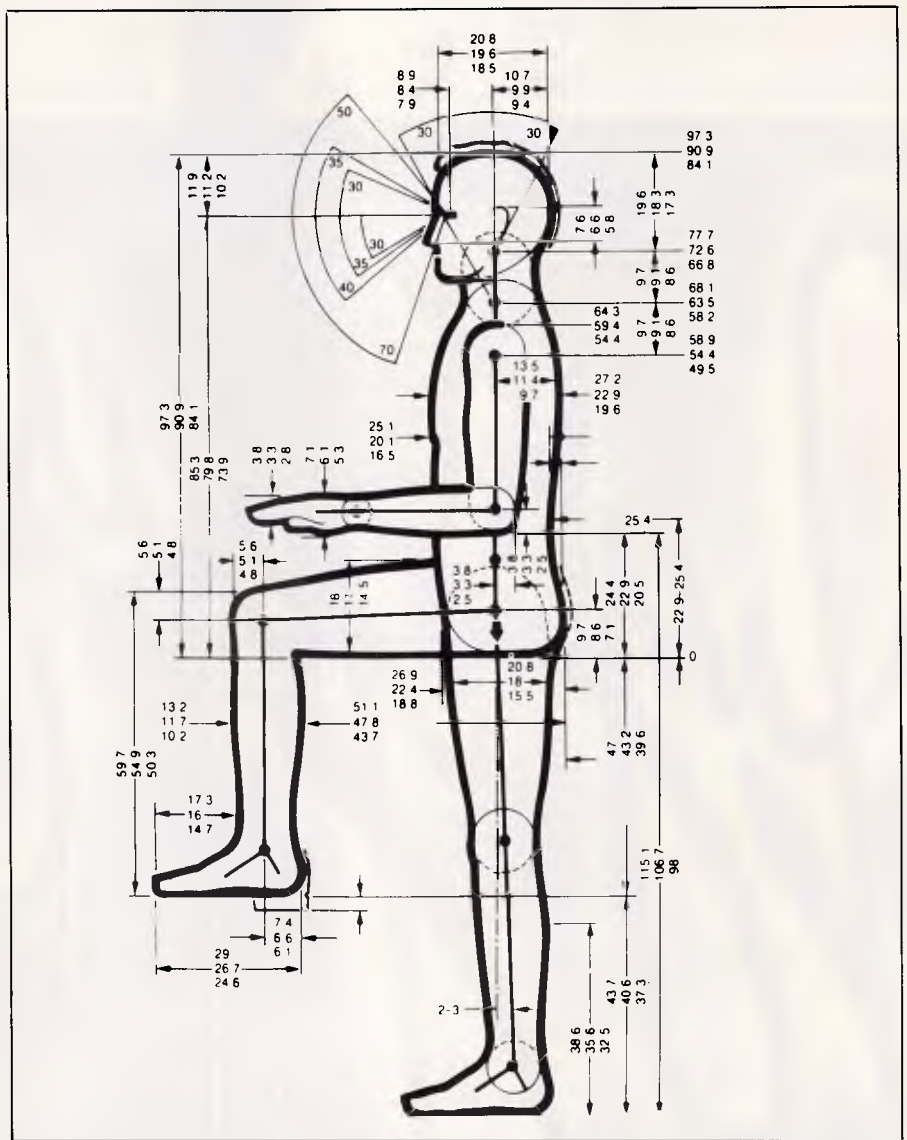
For the person who uses a personal computer at home or uses one (or more) at work, the danger of repetitive strain injury is real.

RSI can strike the professional, the self-employed businessman, the manager and the computer enthusiast just as well as the data entry operator. And when it does, it can mean months of frustrating incapacity with the victim being unable to do dozens of normal everyday domestic and business tasks as well as being unable to use a keyboard.

In addition if the computer is being used in employment, it can mean a substantial increase in workers' compensation premiums. Good ergonomic furniture helps greatly to reduce the likelihood of RSI although it will not prevent it entirely. This is because ergonomic furniture is only one of the three factors which causes RSI. They are: poor working positions, stress or tension, overwork or a large amount of repetitive work.

Stress or tension while working can be an adrenalin rush, a high, or it can be depressing. But in any case it often causes the muscles across the back of the neck to constrict.

Extended work with such tension across the shoulders can cause strain to the muscles, tendons and ligaments



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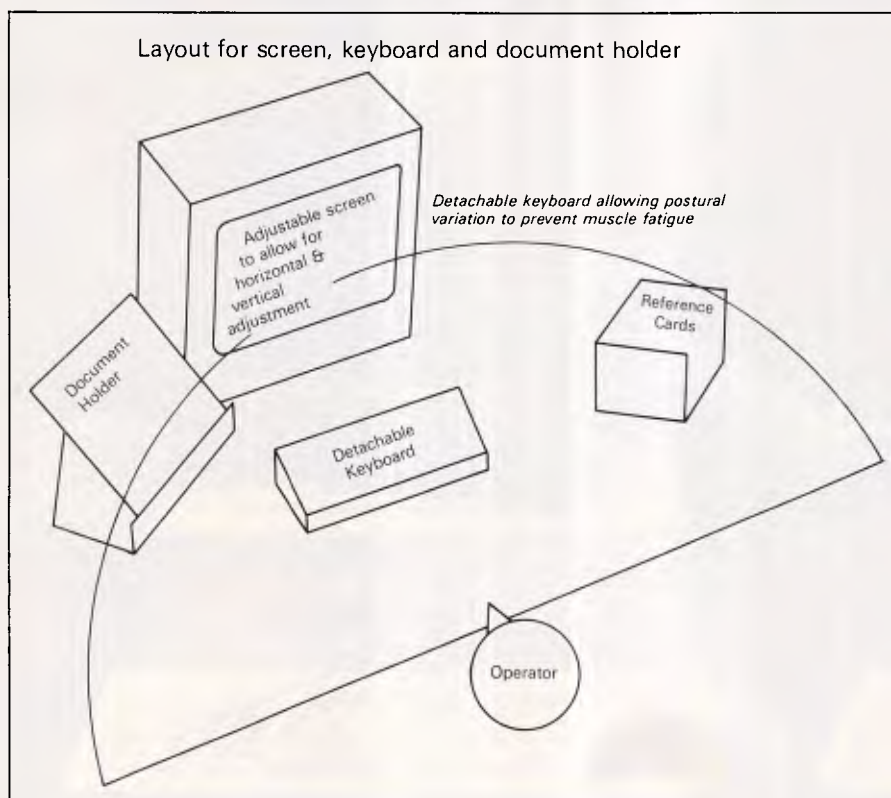


Figure 1: Screen, document holder and reference cards to be placed about the same distance from the operator to avoid unnecessary eye accommodation

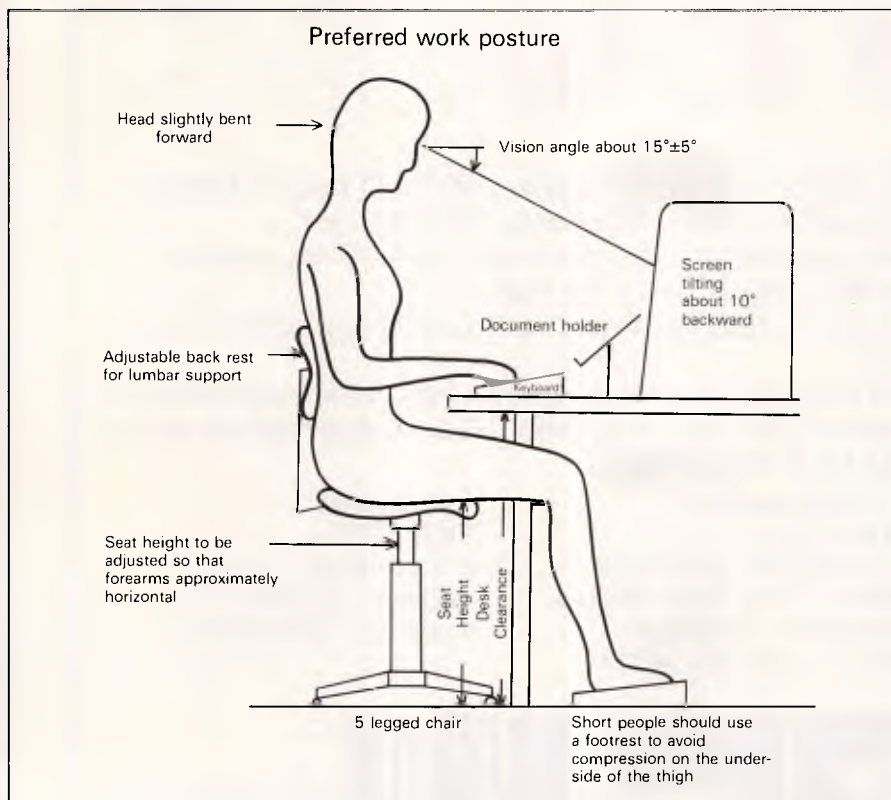


Figure 2: the seat height should be adjustable between 385 and 475mm. The desk height should be adjustable to provide a variable height for the working plane (ie the top of the home row of keys — between 640 and 760mm).

in the arms, hands and wrists. Overwork or a large volume of work — particularly for people who have been away from work for a few weeks — can cause similar problems.

Many severe forms of RSI appear to arise because the wrists simply cannot cope with the amount of work demanded of them for long periods of time. But ergonomic furniture helps reduce the work load on muscles and tendons by allowing people to operate in an efficient position.

Being forced to work in an inefficient position places a person's spine in the wrong position, their muscles will have to work harder and they will tire much sooner and suffer injury much earlier.

But there are some pitfalls in rushing to buy furniture that is called 'ergonomic'.

The word ergonomic is often misused for promotion purposes and there is a lot of 'ergonomic' furniture that is little better than the old-style furniture it is replacing.

The best approach is for a firm to consult an ergonomist which in many cases will be listed under 'Occupational Health and Safety' in Melbourne's Yellow pages or under 'Safety Consultants' in Sydney's Yellow pages.

For smaller businesses or home computer users, the various state health commissions or the National Occupational Health and Safety Commission (Worksafe) may be able to provide advice.

Another approach is for the intending purchaser to look hard at the furniture and see how adjustable it is and how it, the computer hardware, and the immediate environment, suit the computer user.

Ergonomics is however, more than just selecting furniture.

As the director of one of Australia's largest ergonomic firms, Mr Mark Dohrmann, said recently "ergonomics is the science of fitting work to people. A professional ergonomics approach involves the careful examination of each of the factors which affect skilled human performance; body size; motivation; use of muscles and posture; memory; the physical environment; the social environment; training; supervision and skill acquisition."

An ergonomic environment

There are three broad areas in creating an ergonomically sound workstation: the computer hardware itself, the furniture it and the operator sit on; and the

HEALTH & SAFETY

environment the workstation is in.

While there is no such thing as a perfect workstation, the computer operator will profit if an effort is made to create the best workstation conditions achievable. Lets look at some of the guidelines which ergonomists issue for these areas.

The choice of a personal computer itself is the obvious starting point and here is a checklist:

- It is an absolute must that the keyboard be able to be detached from the screen.
- The keyboard should be slim in profile so that the keys are as low as possible on the desk.
- Some guidelines suggest the keyboard height above the desk be no more than 30mm.
- The screen should be able to be tilted and rotated on its base in order to make allowance for variations in seated heights of operators.
- A wrist rest may be required for thicker keyboards.
- The keyboard should be able to be moved to the most comfortable position from time to time.
- It's a good idea to have a glare resistant screen so that any reflection

from nearby lights or windows is diminished.

- The screen itself should have a display readable at a working distance of say no less than half a metre.
- If you are buying a screen, test the character resolution by typing similar characters for example CQ, TV, S5, CG, UV, B8 etc. and go for the screen that has the most clarity.
- The choice of a colour for the screen is a personal one, but it's important that the display be able to provide good colour contrast.
- Most important is that there isn't any perceptible flicker, jitter or shimmer as these accelerate visual fatigue.
- And the screens should have a brightness control to enable personal choice at the time of use.

Let's look at the furniture in the ergonomic workstation. Probably the most important component is the chair.

If you are looking at chairs compare them with this checklist:

- A readily adjustable height, adjustable by the person using it while seated, preferably 'gas' operated.
- It should have a good back support which is adjustable in height.

• The back rest ideally should also be adjustable in its angle and able to tilt backwards when needed.

• The chair should have a swivel top, and no arm rests.

• A five point base is preferable with castors.

• The seat of the chair should have firm padding and its front edge should be curved or waterfall shaped so it doesn't cause localised pressure areas under the thighs.

• It's also a good idea to have a chair in which the centre column besides being continuously adjustable in height, is capable of acting as a shock absorber in the event of an operator dropping into the chair.

When looking at desks, table heights and the overall dimensions are important.

The height of a desk should give thigh clearance. Some desks have an adjustable height — a very useful feature. But normally a desk would have a minimum thigh clearance of 680mm.

Some desks provide a multiple height workstation where two distinct activities, such as keying and writing, are performed. These can be very useful.

But the obvious should not be

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forgotten:

- A desk should be large enough to allow the computer to be moved as required and sufficient to cope with all the work task demands as well as the hands and arms. Don't cramp your work position!

- A footrest helps remove pressure from the underside of thighs and helps a keyboard operator to adopt an acceptable working posture.

Some other furniture pieces can also be useful.

- A document holder can help avoid unfavourable inclination of the head and body movement when shifting vision between documents and the screen. They can be effective in raising the documents to be typed to near the screen height rather than placed on the desk beside the keyboard.

The work environment is an important part of any ergonomic considerations.

Chief factor in the environment is lighting and the keyboard operator should be able to ensure there is no glare on the screen and that any source documents are adequately lit.

For employees, the noise of a printer can be stressful particularly if it bursts into staccato printing at unexpected times. Therefore if you are using a personal computer at work, make sure it is located away from fellow workers or enclosed in an acoustic hood.

By the way, while considering lighting, it may be worthwhile getting your eyes checked if you are 40 or older and having them checked every two years.

Computer screens and the length of time you may spend concentrating on them tend to make heavy demands on the eyes.

As people get older, they are more likely to require glasses for extended visual work.

If you are already wearing glasses, they may not be suitable for computer work because reading glasses often have a focal length between 300mm and 350mm whereas typical reading

distances for screens range from 400mm to 600mm.

But just as every computer user knows, hardware is only part of the story. Just as software is equally important, so is knowledge of how to use ergonomic furniture.

But first, speaking of software — if you use or plan to use your computer extensively be aware that software can have just as much impact on you as the hardware.

There is some hardware that can cause excessive stress and more than necessary punching of the keyboard.

Stress can be caused by having to repeat large volumes of work when input has been lost by system crashes.

The ACTU policy on software could be adopted for most computers. It calls for prompts, error messages, and other diagnostics to be clear and framed in good English.

It says system crashes through operator error should be made impossible and input and stored data be protected from system crashes. It also makes the point that designers of software should receive ergonomic training.

Working with ergonomic furniture

Let's look at some of the guidelines for using your ergonomic furniture (use a mirror or fellow worker to help you with this).

Firstly, adjust the height of the seat of your chair so that with your fingers in the middle row of your keyboard, your forearm is parallel to the floor.

The idea is that your forearm should not be less than 90 degrees angle to your arms. If your forearm is raised higher it will tire more easily and take more effort to work.

Secondly, your thighs should be parallel to the floor and your lower legs at a ninety degree angle or greater to your

thighs. Sitting with your legs tucked back or crossed may block blood circulation and cause pins and needles in your legs.

There should be about a 13cm gap between the front of the chair and the back of the knee.

Thirdly, adjust the height of the backrest of your chair so that it fits the curve of the hollow part of your back (lumbar area). Chair backs that are too high may dig into your shoulder blades and too low may not provide adequate support.

Fourthly, try to arrange your work so that your neck is not twisted or excessively bent. In other words avoid unnecessary turning of your head. If you spend most of the time looking at the screen place it in front of you. Otherwise, if possible place it to one side and your source documents in front.

Fifthly, your wrists should be held in a straight line with the forearm and not raised or bent downwards.

And finally, when not keying, train yourself to get into the habit of dropping your hands onto your lap to rest them. This will make a big difference, especially under pressure.

The busier you are and the tighter the deadline, the more muscle tension there is in your neck, shoulders and arms. Remember people are not well designed for sitting in one place.

Take frequent short breaks — two or three minutes every quarter of an hour. Time spent relaxing is good insurance.

Take note that many Australian universities have introduced a maximum of four hours a day on keyboards for keyboard operator staff.

In Japan, a two hour limit is in place for many keyboard staff to prevent RSI.

But again it is stressed, while ergonomic furniture provides a sound basis for occupational safety, no amount of ergonomic furniture will help if the work load and stress factors are too high.

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PC security

Security is one aspect of computing which doesn't seem important until it's too late. Jan Smith reports on the problems of keeping PC data and equipment safe.

It's ironic that these days the biggest threat to data security comes from the proliferation of the PC itself, where human frailty has tended to obscure traditional perils such as tempest, fire and acts of God.

Well, that's how it looks after rivetting exposés on television, where the activities of hackers are always news. If anything, security experts would rather the media throttled back on hackers, as each success only serves to encourage others; whether it's total strangers, disgruntled employees, or what's now known as 'nappy hackers', (bright school children).

But as Donald Davies, internationally famous security expert and cryptographer, at a recent Housley Communications seminar, said, "There's no point in becoming paranoid about schoolboys being approached by the Mafia to hold the economy to ransom." (It is estimated that it would take only two days downtime to bring, say, the Stock Exchange to its knees).

"The media tend to get carried away by what looks like a break in, when it may be that all the hacker has done is get to the front door, electronically speaking," Davies says.

He points out that after all, it was only a decade ago that enterprising students were involved in the blue box racket, where the US telephone system could be manipulated to allow virtually free long distance phone calls.

But the trouble is that not everyone is as alert as AT&T, who with patient research and not extraordinary cost, put a stop to blue boxes. While international banks have their wits about them, the security consciousness in manufacturing and research, doesn't impress Davies.

Why we need security

Encryption is Davies' field, and the big buzz word at the moment. But he points out there's still a lot of boring, obvious



things you can do closer to home to ensure security.

For instance, people tend to be appallingly lax about disposing a print-out. The classic story is the American student who discovered some handy scribbling paper in an alley, discovered it was a printout from Bell Laboratories, got into the system and ordered himself \$2 million worth of equipment, only to be reported by the delivery man who wanted a piece of the action.

The student ended up being charged with fraud and given a 40 day sentence on condition he accepted a job in Bell's security division. Experts say this is one of the smartest things to do should you catch a hacker, and the student probably agrees, as he is now a consultant, collecting \$20,000 retainers each year from a string of companies.

Users are also becoming very nonchalant about passwords, a safeguard introduced by programmers when today's hackers were in bassinets. Not only do people log on with all sorts of people peering over their shoulders, but the whole idea of the log-on procedure is still based on the idea of user friendliness. Too many systems virtually hold the hand of all users with giveaway prompts such as 'please enter your four letter password' when a curt 'sign on please', would be better.

Even moderately bright law-abiding people have surprisingly little trouble finding the right password. According to professional hacker-watcher Andrew Rosiak of Delta Computer Systems, Parramatta, 'sex' and 'God' are top favourites as are car rego letters.

Remember, too, that hackers have all the time in the world, especially the junior kind who is still living at home. Also, any employee, past or present, with a really deep grudge is not going to be deterred by a little lost sleep.

Built in entrapment devices? Sorry. Donald Davies thinks these devices act like a red rag to a bull, hackers being the sort who love a challenge.

Danger signs to watch for include: anyone taking a suspiciously long time to log on, and anyone browsing through files outside their domain. Also, avoid storing sensitive data such as passwords and accounting balances on ASCII files.

Even if such people are not squirreling away information, they may be implementing some sort of delayed action revenge. For instance a logic bomb, which will destroy the system in six months time, or something called a worm.

A worm is a program which runs between accounts and is capable of regenerating itself if bits are lost. In time

it will eventually overload the system and bring it down.

The good news: it may soon be possible to stall the phone-in hacker by having the computer ask for a telephone number before the caller can proceed.

Types of control

The next step may seem painfully obvious, but apparently it's not unknown for a company to invest in a shredder and then have it locked away when it's needed.

It's also an idea to invest in a crosscut shredder, rather than the type which simply produces long strips which are

'It's also an idea to invest in a crosscut shredder, rather than the type which simply produces long strips which are capable of being put together again.'

capable of being put together again.

Locks in general are another thing computer owners don't think about, both for PCs, diskette storage and offsite backup storage. Insurance people tell dire tales of disk oxide deteriorating in uncongenial environments, and about people who leave disks in the boots of cars or stashed in the wardrobe.

Cylock

One relatively simple protective device is Cylock, marketed in Australia by Anchor Pad of Drummoyne, Sydney. Cylock is designed to regulate access to files and programs by a combination of hardware and software. It consists of a board attached to the back of the PC, a hard disk with information, and silicon chips encoded with a password and other information which keys into a special slot linked to the board.

Cylock is designed to work on IBM PC/XTs and PC/ATs, and also on the Apple Macintosh.

Each authorised employee has a silicon chip key, and once the password is accepted, the PC runs a number of checks and will not display any files except those authorised. The DP manager, or the user, can change the password whenever necessary.

As an extra precaution, Cylock also keeps a log of who accessed the PC, when, what they looked at and what they tried to look at. If approached with a stolen key (provided it has been reported), Cylock will operate on the same lines as an ATM and swallow the key.

Cylock, an American product, is currently being used by the Reserve Bank and BHP.

Dongles

One security device popular overseas, though relatively little known in Australia, is the dongle. Basically a small piece of hardware, a dongle usually consists of a chip inside a cartridge encased in black plastic. This sits on the back of a micro, and only if it is present will the accompanying software run, because the software contains a recorded program which will always check first to see if the dongle is present.

Each package, therefore, has to be sold with a different dongle, but its advantage is that although it doesn't prevent copying, no copy will run on a machine without its matching dongle.

But Dr Bill Caelli, technical director of the security company Eracom at Burleigh Heads, Queensland, has no great opinion of dongles. "People get sick of changing them because you need to attach a different detector for each dongled program, so eventually they stop bothering," he says.

For PCs, Dr Caelli thinks it's better to have a security device built into the machine. As with contraception, it seems that for most users, the best precaution is one which is permanently in place and invisible.

PC Encryptor

"For the ordinary PC user, as opposed to the electronics enthusiast, a security device needs to be transparent and painless," he says, and for users of IBM PCs, PC/XTs and compatibles, Eracom provides the PC Encryptor. A full-sized add-on card which will encrypt, or scramble, all stored data on both hard and floppy disks, costing around \$1000.

The Eracom encryptor board uses the DES (Data Encryption Standard) algorithm on a high-speed integrated circuit chip, and is compatible with both PC-DOS and MS-DOS operating systems. It is locked into the operating system and can only be run on that particular machine. It can be upgraded easily to add communications and key management capabilities, and individual encryption keys can be provided for a single system or a group of systems with a hardware key facility.

The big advantage of the PC encryptor is its transparency, so the user doesn't know it and so there is no temptation to steal or interfere with it.

Prolok

Another device is Prolok, invented by

SECURITY

Norwegian-American Krag Brotby, after his own programs were infiltrated. Prolok comes from the Vault Corporation of America, with Ashton-Tate having a 15 per cent share.

Prolok works by encrypting software, and consists of what looks like an ordinary floppy disk, but it has two laser imprints on the oxide surface, each with its own distinctive characteristics. This difference is recorded on the encryption program, which checks to see if it is present. If not, the program will not run.

Earlier versions of Prolok needed the original system disk to be in Drive A when booting up from hard disk but the new version of Prolok allows the protected program to be copied onto the hard disk, which can thereafter be booted from the hard disk without having to insert the original Prolok system disk in Drive A.

Prolok is distributed in Australia by Communication Control, of Sydney, where director Ross Macarthur is waiting for the verdict from the Louisiana court, where the Vault Corporation is claiming \$120 million from the distributors of a pirate program, or Prolok-cracker. Macarthur believes that if Prolok wins, the sale of Prolok-crackers and

similar security-breaching devices will become a criminal offence.

Filelok

Communication Control also distributes Filelok, which encrypts data on hard disk when placed in Drive A. Decryption can only be done by using the same disk and

*'As with contraception,
it seems that for
most users, the best
precaution is one which
is permanently in place
and invisible.'*

password, which is encrypted onto the data and is not accessible. The user selects his own password for each file.

Meanwhile, software-based encryption had become familiar to users of Ashton-Tate's dBase III Plus, released earlier this year. This has a built-in encryption routine which allows the user to encode a file with a numeric logic key, and is expected to encourage other



software companies to come out with similarly protected software.

Prevention

But for many first-time PC users, data security is not a defence against hackers so much as sensible insurance against their own mistakes. This means backing-up diskettes and making a catalogue of hundreds of floppies, unless you're forward thinking enough to try a hard disk.

Hard disk capacity starts at around 10Mbytes. The majority of hard disks for PCs are manufactured by Tandon, NEC and Seagate. As prices come down, the 10Mbytes is starting to disappear, as it is only \$200 or \$300 less than the 20Mbytes, such as NEC's, which sells for around \$1200. Also available are 40, 44, 60 and 67Mbytes, priced from \$1200 to \$9200, but shop around first.

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On the right course

Choosing the right computer training for your individual needs is an ordeal in itself. Rebecca Nash reports on this important, but often understated fact of computing.

There is a huge and growing market for computer training services, and probably with good reason. It is estimated that only 10 per cent of PCs are actually used to anywhere near their full power. In Australia alone that represents a potential computing power greater than all of the country's mainframes put together.

Doctors, for instance, are still using PCs only as word processors and for doing their accounts, but not much else, when at their fingertips they have access to a very sophisticated diagnostic tool. Engineers in Australia are still behind the rest of the world in using computer-aided design and manufacture. Accountants could profit further from databases on the tax laws and so on. And the benefits of desktop publishing are just waiting to be reaped.

There's plenty of software around, so all that is needed is the time to come to terms with it. And of course for people whose time is valuable, that's where training comes in.

Although all software is supplied with manuals, the low standard of these has achieved the status of a modern myth. Even with an excellent manual, the time taken to work your way through it may actually cost thousands of dollars, if you work out how much it is costing your company.

Training is available to speed things up, but amidst the plethora of courses on offer how do you sort out the wheat from the chaff? There are literally thousands of courses to choose from and finding the best one hinges mainly on the nose of the user in asking the right sort of questions of the training centre in the first place.

Every would-be learner's needs are different, which is one reason why there are so many courses around. One person might simply want training in a specific package. Someone with little or no knowledge of computers will go for a much broader-based course which takes them from scratch to a position of reasonable competence.

There's also Computer Basic Training (CBT), individual tuition, laser disk, individual and group seminars (either on your own company's premises or at learning centres) — the choice is endless.

One key factor to bear in mind at all times when choosing training is that you have to decide what you really want the outcome of any training to be.

It is no good turning up to a seminar or ordering a CBT package if you don't know what you really want to achieve at the end.

According to Neville Smith of NIS Associates, one training course is much like another. What you get out of it will depend on how well the skills you are taught fit in with your needs and abilities. "It's ridiculous to say that every secretary ought to be on a word processor. There are people who are better performing traditional roles," he said.

If, for example, you are a manager responsible for sending staff out for training on a particular system, you should determine in advance which people would be better suited to work on computers. Many an executive or secretary has gone back to work after an expensive training session still unable to cope with what they've been taught.

According to Smith, the design of a training course is relatively simple. More important is choosing the people who come on the course — an issue that training companies in this country are only beginning to address. Any training company worth its salt should ask certain critical questions of the potential client, says Smith, and if they don't, think again about using them.

They should be asking about the type of people they would be dealing with. And they ought to be able to state clearly the outcome of the training in performance terms — not "Mary can operate the computer today which she couldn't yesterday."

Whoever goes on the course should come away with skills that can actually be of use to that person, and they must

be able to adapt what they learned in a classroom environment to the real world.

Retraining is another thing to bear in mind. With the sort of fees charged for training — an average one day session costs around \$200 per day per person — it would seem like a waste to complacently train people knowing that they will soon forget what they have learned. But this can be the case unless follow-up courses are offered.

You have to find a course that offers a bit more than just information about the package, says David Tow, director of the Australian Software Research Centre. It should ideally be business-orientated, exploring how training can benefit an organisation as well as the individual and how the technology will fit into the organisation.

As a trainer for a number of industry associations, Tow takes people whose traditional jobs have been affected by technology and updates their generic skills for use in the business environment.

Training, in his opinion, should encourage a greater understanding of background theory. "It's all very well attending a short sharp training course which teaches you how to key in information to a particular spreadsheet package. But that is probably the limit of the user's knowledge and this does not equip him or her to extend that information into other areas," says Tow.

As much of the technology is so new, and always changing, the demand for computer training is immense. The demand for training in popular packages like the Lotus 1-2-3 can hardly be met at the moment.

For example, MTE's Lotus courses are full for months ahead. MTE, which operates in Melbourne and Sydney, is possibly the largest PC trainer in the country. Its courses are aimed primarily at the end-user executive or manager, although the company runs numerous seminars and workshops for engineers,

TRAINING

sales and marketing managers, accountants, for the government sector, DP people, overviews for managers and executives, and so on. General manager of MTE, Jo Mula, said that 10,000 people attended its courses in 1985. This year, MTE opened a new 'hands-on' centre in Perth.

Mula said that many newcomers to PCs are actually scared of the machines. Even though people realise that they will have to work with them for the rest of their working lives, the ice has to be broken first. This can be achieved, says Mula, by keeping beginners' courses very low-key and reducing any anxiety in the environment. So instead of pictures of the dreaded computers on the walls, MTE displays more tranquil scenes of flowers for instance. Teachers aim to take the mystique out of the software by

highlighting where to find what in the manuals and looking directly at what the user's problems are and how the user can practically apply the tools he or she has learned.

A two-day seminar from MTE costs \$435 per person, but there are special rates for group bookings and courses are limited to 12 people.

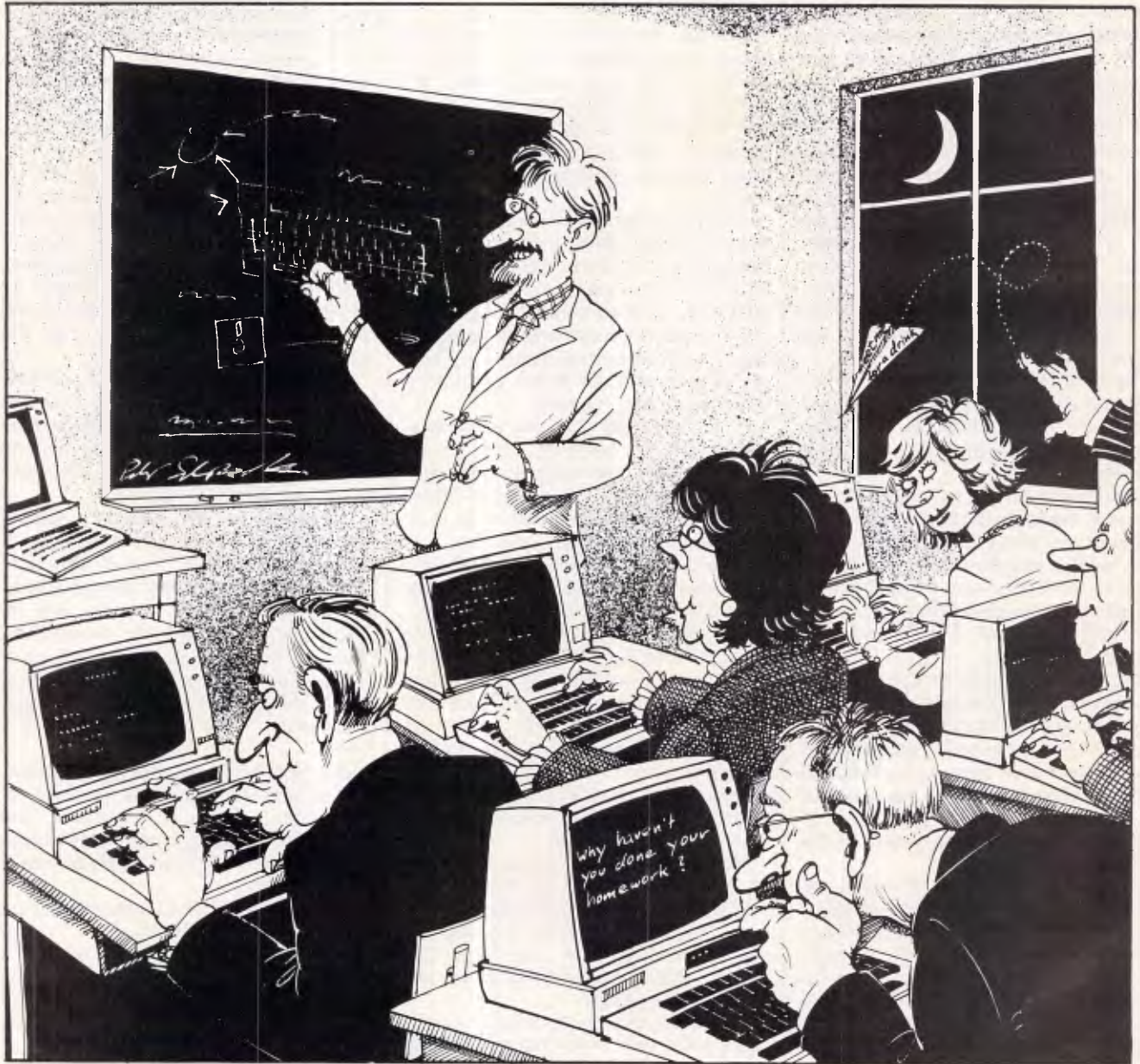
While the technology of computing continues to advance, so does the technology of training. For the time being, though, live training will be hard to beat. Even training companies who deal in computer-based packages admit that face to face teaching will always remain popular.

For a start, it's a familiar form of teaching — we're all used to it after spending years at school. And it's a good excuse for a day or two out of the office to

break the routine. It is well accepted that people benefit from interaction with their teachers and other students — though this diminishes if classes become large and impersonal. The most effective courses should really take not many more than 10 people at a time.

Ish Rajendram, managing director of the Australian Centre for Computer Science (ACCS) says that courses — particularly those using hands-on experience — should not be too complicated. Potential trainees would be well advised to set realistic goals and discuss these with the training company before they enroll. As most courses run for one or two days only it stands to reason that there is only so much that can be taught and absorbed.

The most difficult thing for any teacher, according to Rajendram, is to



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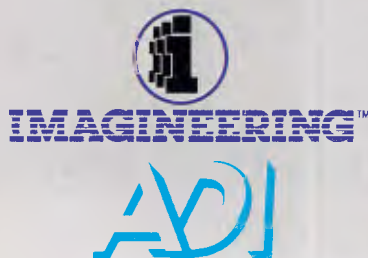
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address people on their own level. Although the trainer may know six different spreadsheet programs, bombarding a newcomer with all of them at once will result only in confusion.

With face to face training you are at the mercy of the teacher's whims or communication methods — and communication problems. Really good teachers are few and far between (all the formal qualifications in the world won't necessarily make a good communicator) but when checking out a company you can at least ask for the tutors' credentials. However, face to face tuition is often an unknown quantity — it is very difficult to tell whether you will get a good teacher or not except by previous experience.

Computer-based training (CBT) is an

alternative to face to face training that is slowly becoming more widely accepted. Ideally it should be used in conjunction with face to face tuition. Its main advantages are that once paid for a CBT package can be used many times, any time and anywhere, and that the user can go at his or her own pace. While CBT is relatively new to Australia it is more commonly used in the US, Canada and Britain and has been so for the last 10 years or so.

While it may be less expensive than face to face learning, whether it is actually more economical in terms of learning time is debatable.

Of course, CBT is not the only form of inexpensive and flexible training. The already familiar packages of cassettes

that form the basis of many people's holiday French are another alternative, even when training people about computers. Teach yourself books are another possibility, although they are a little cumbersome and time consuming to use, as the user is often required to read a book and the screen at the same time.

Interactive video disks combine computer-based training with another medium — the video disk. They have the advantage of books and other non-computer media, in that they can combine speech, diagrams and even pictures. And they have the advantages of computer-based training, in that the user can be tested for understanding.

Most video disk training courses will

TRAINING

— at the very least — ask you pertinent questions such as 'do you understand so far?', and if you don't, will lead you through a series of steps until you do understand. Some will even set a test and then respond according to your score.

Because they can show keyboards, disk drives and so on, video disks are especially useful with introductory courses on things like DOS and learning about the computer itself, but are probably not necessary for more sophisticated programs where the user is already familiar with the nuts and bolts.

Computerland is one of several companies that have incorporated laser disk technology into training programs. The company uses the Computerprep series of books in conjunction with a course. Short term hire is \$150 a day or \$500 a week. Three people can use it at one time.

Regular classes with group tuition are held at Computerland's learning centres on a daily basis covering a range of subjects including DOS, Lotus 1-2-3, Multimate, and dBase. Introductory courses for one evening a week or for four weeks full time are designed for those with no computer knowledge at all

or for people who are thinking of buying a computer.

A small company may not find the investment of buying a complete interactive video package costing say \$9000 worthwhile but a larger company with employees spread across the country should consider the time and



money saved on travel and accommodation costs, as well as time taken off the job to attend courses.

According to Ian Gray, business development manager for Syme Information Technology, \$9000 buys you an IBM (or compatible) computer, video disk player, monitor and keyboard. The company produces interactive

training disks for a number of purposes including telephone programs aimed at organisations where large numbers of their staff spend most of their time answering telephone calls; packages in report writing, letters and other written communication, and marketing. Upcoming titles are interviewing skills, selling, and finance for unfinancial managers.

Of course, commercial organisations are not the only places for training. Most universities, and a lot of technical colleges, offer courses too.

Choosing computer training is a difficult business. For a start, by its very nature computer training trains people in subjects which are new. That means that many of the training companies themselves, a lot of the trainers and most of the course material are also new. So there is a lot of potential for wasting money on courses that have 'bugs'.

In general, the most that you can do is to stick with companies that are known to you — either from your own company's experiences or from other people's. Also, always set out what you hope to achieve *before* you start looking.

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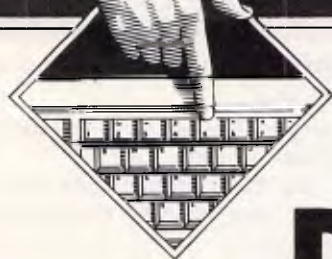
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Data entry

Data entry is no longer limited to the humble keyboard.
Keven Bergin reports on a variety of devices designed for the job on hand.

With some products the means of entering or 'capturing' data varies. However, data entry is still dominated by the humble hard working keyboard, hooked up to a terminal or a PC. Most PC users have been reasonably content to use the keyboard to enter data and some form of disk to capture the information. There are however, many ways of entering and capturing data using micros.

All data is stored for varying periods in RAM. The longer incoming data is held in RAM, the more susceptible it is to damage, corruption or complete loss. Power strikes, surges and dips can play havoc with PCs and often do. However, there are boxes to make sure that the power supply is clean of (expensive) battery backups, which allow the user time to save data.

The most important aspect of RAM is how it is refreshed by the processor. There are currently two main types of RAM, 'dynamic' and 'static'. Static RAM holds data as long as power is applied, while dynamic RAM needs to be refreshed every few milliseconds. Dynamic RAM needs extra circuitry for the refresh action, but lower cost has meant that this type of RAM has become more popular in the microcomputer industry. It then follows that the use of static RAM would be preferable, resulting in more reliable and faster data capture, but would also mean that the prices of micros would increase significantly.

Mice

So far we have touched on the keyboard as a means of data entry. We have also mentioned the part that RAM plays in data capture, and the role of disk drives as permanent storage (except in cases of accident). There are several less used devices for entering data. The most prominent of these is the mouse. In some cases and for some users, the mouse has become the primary device

for entering data, with the keyboard becoming a secondary device.

The mouse is still only used as a secondary device for applications such as spreadsheets and word processors, but takes the front seat in the current versions of desktop publishing applications, as found on the 68000 based Apple Macintosh and the Commodore Amiga.

Mice can be used in such applications to select pop-up or pull-down menus and choose functions. Beyond these, a

'In some cases and for some users, the mouse has become the primary device for entering data, with the keyboard becoming a secondary device.'

mouse can be used for 'cut and paste' operations and can also be used as a 'paint brush' inside graphics design applications. Those who remember the Apple Lisa, will also remember that it was one of the first micros to make extensive use of a mouse. The mouse can now be used as an input device on most micros. Some micros, as previously mentioned come with a mouse and have the appropriate drivers within the operating system. Others will need specialised software (drivers) to use a mouse instead of, or with the keyboard. Of course commercial applications will, in general need to be able to utilise a mouse.

MS-DOS users can obtain a mouse from Microsoft which is supplied with software and can be used with many PC applications.

The mouse is a small (palm sized) device which is connected to the main unit by a thin cable, which is operated by

rolling it over a smooth surface. The movement of the mouse is measured by the rotation of the ball (in much the same way as a trackball functions), which moves over the surface (desk or board) and is followed by the cursor (on the screen of course).

Some functions are selected by pressing one of the two buttons (usually situated on the top of the mouse), or by moving the cursor to designated areas of the screen and pressing (clicking is a current buzz word) one of the mouse buttons once or twice. In this way the mouse can execute programs, or be used inside programs to carry out many functions.

Joysticks

Another data entry device is the joystick. One assumes it has the name joystick, because of its use with games and the constant source of entertainment and amusement it brings into computer users otherwise boring lives.

In any event, joysticks are primarily used with games and the most primitive are capable of the forward, backward and sideways movements. More sophisticated joysticks have eight or 16 positions, as in the Trackball (rather like a mouse in operation and in design). Joysticks can be used in serious applications, but their use is usually rather limited.

Light pens

The light pen is another method of entering data without the use of a keyboard. It is a pen shaped device containing a light sensitive electronic unit. The head of the pen is pointed to a spot on the screen surface and a light pulse is detected when the CRT electron beam crosses the pen during its raster scan.

The light pen's timing supplies sufficient information for the micro to calcu-

late the coordinates of the pen. The signal can be used to select options, or more commonly, can be used with design packages (CAD/CAM) to create and edit diagrams.

Following closely from the light pen is the digipad. This device can also be used with design packages, but is more commonly used with graphics packages to create a variety of screen images. Some games software houses employ graphic artists who create all those exciting and colourful screens, using a graphics package and a digipad.

The digipad comprises a large tablet and an electronic pen. The pen is used to

create diagrams, which can be entered free-hand or traced, and most tablets usually have special areas on the tablet to select specific functions (ie change palette or save data).

Optical character readers

Until recently, the size and price of optical character readers have meant that they must be used primarily on large machines. However, there are now some optical character readers that come within the price range of most micro users.

OCR's look like a miniature drawing board with a sliding rule running up and down a rail on the left-hand side of the machine, which slides left and right along the ruler. This is the read head, which converts text from the page into ASCII codes and sends the information via the serial interface.

One such OCR, the Omni-Reader, has a standard external power supply and uses a standard RS232 interface (the standard IBM modem cable works fine with the Omni-Reader).

The protocol and pitch are set with a combination of the two banks of dip switches. Text is read from the page by



moving the read head over one line at a time. The Omni-Reader checks the input and reports any errors.

The read time is between one and three seconds, which will accommodate most hands. There is a numeric mode to allow fast entry of numeric data.

The data can be captured on a PC, or other micros, by putting the output directly to a file, or inside applications like word processors and spreadsheets, where interfacing software is available. The Omni-Reader is distributed by Audio Engineers, (Telephone (02) 29 6731) and sells for \$1500.

Remote devices

Datacraft offers a number of remote devices that can be used with micros. By far the most interesting is TATS (Tone Activated Talking Switch).

The user dials into a system, logs on and TATS recites the choices you have via pre-programmed messages. It also has a backup modem facility which will allow you to change ports remotely, and after any selection it recites the selection to you.

TATS also offers a security system and customised eproms to suit your needs or responses.

The TATS system leads straight onto another method of entering and capturing data. Communications programs are by now in widespread use by micro users. The basic requirements are a micro and a modem.

The most common modems in use with PC's are Hayes-compatible. These modems generally offer a range of speeds from 300/300 to 4800. In practice over voice lines 1200/1200 is the fastest you can get.

To use a modem you will require a communications package. Packages such as Crosstalk, PCTalk, Multilink and LANLink all have main features in common. They allow the user to set modem protocol, and to connect to other systems via a telephone line, direct line, or a cable directly connecting two systems. Having connected two systems, the communications program can be used at one end to send data from the keyboard, or more usefully, from a file to the receiving system. The receiving system can then be placed in automatic capture mode, to receive all of the data and write it out to a file or file(s) on disk.

There are also many other methods of entering and capturing data. CSIRO use light pens to enter data on PCs and also use sensors to capture data. Unfortunately, exactly what the data is could not be ascertained for this article. Perhaps there was a reluctance on

CSIRO's behalf to part with this information.

Data sensors are used generally in industry to gauge heat, humidity etc, and are also used in alarm systems to gauge and report changes.

The most powerful form of data entry will undoubtedly be voice entered data. While this is currently possible, it is still a tedious task teaching the machine an individual's voice pattern so that it will recognise the words and respond to them.

Hand held devices

These devices are small battery powered terminals which can be connected to a PC, or other computers and upload or have data downloaded to them. They can also be used to enter data and to verify data.

One of the most obvious areas of use is in large department stores, to check prices and current numbers of individual items. The results can then be fed back into the main system, and stock control applications can alter and re-order items automatically.

Coles supermarkets currently use devices of this sort, and many stores are either using them, or evaluating similar products.

Department stores also make good use of bar code readers such as the Pathfinder. It has the ability to design label formats, print alphanumeric characters, set up prompts for data entry, select font, style, pitch, specify check digit or bar code printing, specify multiple price fields and design up to eight fields per format. The data can be downloaded from a PC to the Pathfinder and can also be uploaded to the PC, so that a record of the work achieved can be taken by the PC and acted upon.

Some computer magazines (notably Byte in the US) have strips, similar to bar codes. These strips represent programs and instead of the laborious task of typing them in to see if they work, this way, if the program is usable, the user merely

scans the codes with a pen shaped instrument which is hooked up to a PC, and the program is entered into your micro.

For users who often use a word processor, there is a device, called the Microwriter: an ingenious six key, battered power 'word processor'.

It can be connected to a monitor, printer or another PC, via the one RS232 interface on board. It will also save text to tape. The Microwriter is only 23cm x 11.7cm x 5cm and weighs 735 grams.

Its design means that with the palm of the right hand resting on the base, the fingers and thumb are poised above the six keys. Characters are entered by pressing a combination of the keys, with the left sixth key acting as a command key.

The 16 character LCD not only displays text, but reserves the two rightmost characters for various settings, and for warnings such as memory full, or battery low. There are two versions of the Microwriter: 8k and 16k costing \$695 and \$995 respectively.

The Sharp PC 1600 has been dubbed a pocket computer and is not much larger than a programmable calculator (19.5cm x 8.6cm x 2.5cm) and weighs 390 grams.

The PC 1600 comes with a Z80A compatible processor and 16k RAM (expandable to 80k). The basic unit costs \$650. The printer/cassette interface costs \$650, and the 32k modules sell for \$295 each.

The operating system is on ROM and is integrated with Basic, the machine's native language. It has a 63 keyboard, including a numeric keypad and a 25 x 4 lines text, 156 x 32 pixels graphics, LCD display, an RS232C port, an expansion bus, disk drive, an optical fibre serial port and printer plotter.

The PC 1600 is driven by rechargeable batteries. It does represent yesterday's technology, but instead of having a mediocre micro on your desk, the PC 1600 lets you slip it in your pocket.





It's your choice - rent, buy or lease

*Why pay cash for a PC when renting or leasing may suit you better.
Stephen Kelley looks at these alternatives.*

So you've decided to take the plunge and put PCs into your company. Or perhaps you already have a raft load of computers and now want to upgrade to faster, more powerful equipment.

You've talked to suppliers, evaluated the hardware, made sure that all the various components work together and have generally done everything a consumer who believes in caveat emptor does.

But now comes a question of an entirely different complexion — how to pay for it.

There are three ways to do this — pay cash, lease the machine, or rent it. All three have advantages and disadvantages.

'There is one key difference between buying a PC and leasing or renting the machine — when you buy you use your own money and it is gone.'

There is one key difference between buying a PC and leasing or renting the machine — when you buy you use your own money and it is gone. Your money is now tied up in a piece of depreciating equipment. If the machine is for business, you write the expense off against tax. You can maintain your own books and claim depreciation on the machine — up to 33 per cent per year.

But apart from claiming for items such as floppy disks, printer paper and printer ribbons, that is virtually the extent of the claims you can make on the government. Tax advantages are minimal and generally only apply to the year of purchase.

On the other hand, leasing or renting your PC, while costing more on paper, has advantages of its own. To start with, you are now buying the machinery with someone else's money. This means your funds are not tied up and you are free to invest that money in something more

profitable.

You can no longer claim depreciation (you don't really own the machine), but you can charge your lease or rental fee against tax with potentially greater savings.

What's more, the larger the purchase, the potentially greater the tax savings. Every dollar written off in paying the rent or lease is 46 per cent (based on existing company rates of taxation) less that you are putting into the government coffers.

To illustrate, let's take a typical PC

Years	Residual	Pymt/ month	Total	Purchase price	Funds forgone
3 years	\$1000	\$127.95	\$5606.20	\$3999	\$1607.20
4 years	\$400	\$116.03	\$5969.44	\$3999	\$1970.44
5 years	\$1	\$105.79	\$6348.40	\$3999	\$2349.40

The total payment is calculated by the simple formula: Pymt/month x # residual.

Figure 1

Years	Residual	Pymt/ month	Total	Purchase price	Tax saved	Funds forgone
3 years	\$1000	\$127.95	\$5606.20	\$3999	\$2578.85	\$-971.65
4 years	\$400	\$116.03	\$5969.44	\$3999	\$2745.94	\$-775.50
5 years	\$1	\$105.79	\$6348.40	\$3999	\$2920.26	\$-570.86

Figure 2

Age	Depreciation	Value	'Tax rebate'
New	\$nil	\$3999	\$nil
1st year	\$1333	\$2666	\$613.18
2nd year	\$1333	\$1333	\$613.18
3rd year	\$1333	\$nil	\$613.18

Figure 3



clone: the Australian-made President Turbo. It has a processor that runs faster than the IBM PC and comes with 640k of memory and two standard IBM format disk drives. Add a 20Mbytes hard disk and colour graphics and it will cost you \$3999 including sales tax.

An IBM PC of similar configuration costs at least \$500 more while AT prices start around the \$6000 mark. For the sake of simplicity, this example excludes other items you may purchase at the same time, such as a printer, expansion boards, high resolution graphics cards, monitor and so on. We will also assume that the machine was bought or leased on the first day of the financial year, and no allowance has

been made for any possible stamp duty.

For the above mentioned President, the monthly lease fee will depend on the time allowed to pay off the machine and the residual paid out.

The Australian Guarantee Corporation for example, offers the following terms (see Figure 1) which could have just as easily have come from Custom Credit, Barclays or any of the other numerous leasing companies.

The 'Funds forgone' column is the difference between the purchase price and the total lease price. However, these figures do not tell the full story.

To begin with, you can write off the total leasing charge against tax, in effect

getting a rebate from the government of 46 per cent in the dollar.

When this is taken into account, the cost of leasing changes, see Figure 2.

As you can see from the figures, leasing for three years and then paying the \$1000 residual works out cheaper than buying the machine outright. With the added advantage that your funds are still free to be used for other things.

There is however, more to the equation than this. Because if we buy the computer outright, we still have to allow for depreciation. And this again changes the picture.

Let's say we depreciate our \$3999 computer at 33 per cent per year over three years, then the value of the machine declines as shown in Figure 3.

Subtract the total depreciation 'rebate' or \$1839.54 (obtained by adding up the amount we can claim against company tax) from the original purchase price and our PC has cost us \$2159.46. By comparison, our leased computer has cost (after 'tax paid' has been subtracted from the original purchase price), a total of:

3 years	\$3027.35
4 years	\$3223.50
5 years	\$3428.14

The equation would look even more attractive if we made the (perhaps unfounded) assumption that we can invest the money at a better rate of return than the interest we are being charged for the computer. In this case we have to get a rate of return better than 19.7 per cent.

However the above figures are not gospel and can change from day to day, depending on a host of factors including the current interest rates and the sheer availability of money (since it is the leasing company that has paid your dealer and is now collecting interest on what is effectively a loan). Shop around. Don't take the first price offered, they can vary.

Perhaps what the figures show more than anything else is that there is not a huge difference between the two methods of buying.

As Gus Vitale, a Business/Finance Advisor with Australian Guarantee Corporation says, "It's a very individual thing and depends enormously on circumstances."

"To work out the best way of going about financing a computer, you really should talk to a good accountant. Your accountant knows your financial position and is in the best position to advise you."

Arguably, the most economic way of funding a PC purchase is to borrow the money at around the same rate of interest being charged by a lease company and then buy the machine outright, thereby avoiding stamp duty. You then claim

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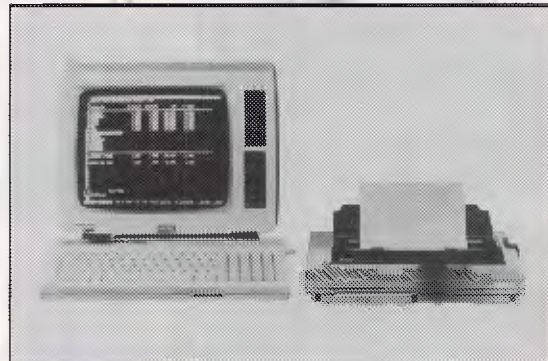
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depreciation at the full rate for three years, claiming that depreciation against tax. At the same time, you claim against your loan repayments on the computer, thus having your cake and eating it too. Whether you go this way depends on whether you want to maximise your tax advantages over three years, or maximise your cash flow over five years. If the latter, you take a long term lease instead.

Renting

Another means of financing computer use is through rental.

Mike Collins is the General Manager of Tech Rentals and has recently written a booklet titled 'The Case for Electronic Equipment Rental'.

In it, he outlines a large number of scenarios where renting makes more sense than purchase or leasing. These include obtaining a machine for a short period so it can be conveniently assessed, adding machines during periods of peak demand or during emergencies such as a machine breakdown, or when user requirements are uncertain.

"And with rental you only pay while you use the equipment, with ownership or leasing, you pay all the time," Collins says.

Unlike leasing, rental includes full service. If the machine goes down for any reason, it is the rental company's responsibility to have you up and running again in a hurry, even if it has to replace the machine.

There are other advantages too. Equipment can be returned as soon as you have finished with it, changed if it becomes obsolete or unsuitable and returned during annual holidays.

And finally you can optimise taxation as rental costs are fully tax deductible.

Depending on the company, you can rent for periods as short as a day or for as long as you want.

"We have customers who rent for 18 months plus. And there are discounts for longer terms," Collins says.

"An extreme case of short term rental is Arcom Pacific, the software distributors which sometimes rent up to 10 machines, including ATs, just for a few days. Most of the machines at its stand at computer shows are rented from Tech Rentals."

"But a company may find that it can get by on a certain number of machines except for peak periods when it can then rent the extra computers it needs until the demand drops back to normal."

"Handled this way, computers can be financed very economically since you only ever pay for the computing power you need."

The company inventory includes IBM, Apple and Compaq and includes ATs and

PCs as well as a wide range of specialist equipment.

According to Vetta Malyna, senior consultant and manager of the PC Department of Deloitte Haskins and Sells, leasing is increasing in popularity.

She says Deloitte often recommends leasing, particularly where there are a large number of machines involved, simply because it improves the cash flow situation by letting you spread payments over three to five years.

"There's another thing too," she adds, "when a large system is introduced, customers always think its going to work faster than it actually will. And they don't realise that there will be a temporary loss of productivity while everyone learns the system."

"By leasing and spreading payments out over three or more years, the client is not hit by the temporary fall in productivity immediately after having outlaid a large sum of money. In the case of a business that's teetering near the edge, this could be the difference between failing and continuing to trade." There are however traps in leasing, she says.

"The down side to leasing is that the lease company keeps paying and under the terms of the contract, you must too," she explains.

"However if there are problems with the machine or the vendor goes out of business or supplies inadequate support, you have no leverage on the dealer because the lease company is still paying the bills."

Depending on the terms of the contract, you may not even be able to take action against a vendor who has failed to deliver satisfaction because you may not be the legal owner of the equipment. And the lease company certainly isn't going to buy into such an argument.

Tom Cooper, managing director of President Computers, says leasing has become very popular.

"In fact these days, the ratio between sales and lease deals would be very close to 50:50," he says.

"There are a lot of advantages to leasing because of the tax laws. It costs more in terms of the outlay, but this is counterbalanced by the tax savings. Leasing is tax deductible. And it means the buyer has a low outlay. This is something that government departments with small budgets like."

Mr Cooper believes that is no ideal answer for any buyer. "It's very much an individual decision," he says, "but all the big companies do it so there must be good reasons behind it."

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Are you covered for the unexpected?

Micros are subject to breakdowns as any other piece of electronic equipment and the cost of disaster recovery can be enormous. Jan Smith reports on how you can cover yourself.

Everyone laughs at the stories about support engineers being called in at vast expense only to find the PC wasn't plugged in, but it still happens more often than you would think, for the simple reason that there are a lot of things to plug in on a computer.

PCs are in the category of electric toasters — something where you should resist the temptation to go poking about. But the feeling among experienced users is that it's a bit ridiculous to take a hard-line attitude, and with a little common sense, you can check whether the chips have become loosened, perhaps as a result of moving the PC.

Naturally you do not use sharp metal objects, such as tweezers. Just press lightly with the fingers to ensure everything is tight. Also, resist any urges to tinker with the transformer area, which probably has a stern warning attached. Even if the machine is turned off, you can still get a shock. Nor should you touch the disk drives.

If the disk drives stop, a lot depends on what sort of a PC you have. Compared with what some major suppliers would charge to repair a disk drive, you could be better off buying a new one for about \$300.

Maintenance contracts

Dick Smith Electronics claims that with its Multitech, there are few problems, although it could be a little early yet to tell. It also boasts a super-stringent quality control, with every PC tested for 24 hours prior to sale.

"We've found that any problems usually show up in the first weeks," says Shaun Hogg, service, marketing and administration manager. Dick Smith offers support agreements for three, six or twelve months, usually the on-site or carry-in type.

Most small to large business firms whose PCs are in constant use (or conceivably used only a couple of hours but for something extremely vital), prefer the on-site type of contract. In this case payment is a percentage of the retail price,

'Compared with what some major suppliers would charge to repair a disk drive, you could be better off buying a new one for about \$300.'

with adjustments either way depending on the likely time involved and the feasibility of exchanging parts. A fully equipped van with most parts you could possibly need will come at short notice, for which you pay \$536 a year for a Multitech PC 500 with a 10Mbytes disk drive, \$631 for a Multitech PC 700 and only \$337 for a dual drive PC 700 without a hard disk. Dick Smith also services the Commodore 64 and the Vic 20.

If you can spare the time to bring the offending machine in yourself the corresponding cost will be \$240, \$284 and

\$152 per year, with a 72 hour turnaround time.

This arrangement is popular with executive and professional people who keep a PC at home, Hogg finds.

Dick Smith also has an extended warranty, which is another name for its technical support agreement. You get this automatically for six months with Multitech PCs, which means any problems are dealt with free, on site. In 99 per cent of cases the problem can be rectified at the time, but in exceptional circumstances you could qualify for a replacement while your machine is down.

Finally, you might like to operate on a time and materials basis, which applies to other Dick Smith Electronic products as well as its PCs, and which costs \$48 per hour plus parts.

But whichever way you want to go, Dick Smith warns that you should still be vigilant about paperclips, cigarette ash and dust, which can cause sticking keys and interfere with disk drives.

At Parity, a major IBM PC dealer supplying hardware, software, training and full support service, there is a similar four-tier approach to maintenance. Neville Marsh, computer division general manager, says a key consideration with maintenance is how much the user will be inconvenienced. Even though a PC may not be working from 9am till 5pm every day, it might be involved in some critical application which would take a week for two people to do by hand.

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Program size:	Approx. 32Kbytes.
Memory requirement:	48 bytes minimum.

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MAINTENANCE/INSURANCE

financially healthy and well stocked with the right kind of spares and technical skills. The normal response time with Parity is within four hours, but again, it's not how long it takes to respond, but how long you're without a computer.

Note also that organisations such as Parity quiver at words like 'guarantee', and prefer 'targeted repair turn-around'. Parity's is 24 hours for return-to-base contracts, and five days with extended warranty.

If you are optimistic and choose a time and materials arrangement, it is best to brush up on prevention. With PCs, alas, the classic advice about use it or lose it does not apply. Those in a productive environment definitely develop more problems, notably in the disk drives and memory chips. Although PCs are designed to be somewhat portable, transporting them in an uncushioned place like the boot of a car is a bad idea, as it could jar the disk drives.

Some PCs, however, have a mechanism which, when they're logged off, removes the head from the surface area of the disk so it is no longer sensitive to impact.

Apple has a number of options. There is a 90 day limited warranty which can be extended to one year by filling out a form you get on purchase, and returning it. Once out of warranty, you can have AppleCare, which for a small annual fee (\$276 on a \$4845 Mac Plus or \$198 on a \$2345 Apple IIe) will cover parts and labour on a carry-in basis. This is sold through Apple dealers. A lot of Apple dealers also offer their own carry-in service contracts, and also some on-site.

Apple has contracted with Honeywell to provide on-site service. Honeywell has 52 locations throughout Australia but initially this applies only in capital cities. You can also pay Honeywell or your Apple dealer on a time and materials basis.

Greg Buchanan, Apple's engineering services manager for Australia, lists a number of common problems as well as preventive approaches. He puts trouble spots in this order — power supply, logic board, disk drives and keyboards.

In areas with heavy industrial noise, especially Perth where the power voltage gets up to 260 or higher (normal is 240 volts plus or minus 15 per cent), you can get noise spikes on the top of the waves. These can affect a computer if the power supply is not adequately filtered.

In this situation you should use a line conditioner to suppress the spikes. Buchanan says Apple recommends the battery-operated type from Jaymac Electronics of Melbourne.

Line conditioners are also effective against tropical thunderstorms, but too

much humidity is less of a problem than too little. PCs like a temperature around 22°C and 50 per cent relative humidity. Above this, they tend to corrode, and below, you get static charges of several thousand volts on contact.

Buchanan recommends good air conditioning, anti-static carpets with no nylon (such as those sold by 3M), and anti-static tiles.

Static affects logic boards and disk drives. Disk drives are also vulnerable to smoke, grease and crumbs. On hard disks, the heads don't actually touch the



disk, but hover over it to read the data, and these pollutants close the gap.

Still, there are Apples being used in sawmills which appear to be thriving.

A basic mistake is to switch the PC on with the floppy disk in a drive. This causes a power spike which can demagnetise your data. Be careful, too, to put back the plates which cover the board slots on machines like the Apple IIe. Rats and cockroaches can snuggle in, attracted by the warmth, and chew the circuit boards before electrocuting themselves.

Insurance

Having done all that is possible to keep your PC comfortable and provide skilled attention, you will now have to ensure you keep the PC in your possession. All leading insurance companies now have policies for computers. These usually cover hardware, applications software, costs of temporary hire of replacements and lost or damaged data.

Although insurance companies tend to ask 'domestic or commercial?' domestic is strictly for the hobbyist. If you happen to write novels or run a trucking empire from home, that's commercial.

John Arena, domestic insurance counsellor at GIO, says if it's purely domestic insurance, the cost depends on where you live. If your PC is worth \$1500 or more your house must comply with certain safety standards, and if you live in a high risk area you must meet these criteria regardless of how much your PC costs.

GIO, will expect double cylinder key operated deadlocks on all external doors and key operated window locks on all windows. If you live in a low risk suburb, such as Gladesville in Sydney, the premium is at the discretion of the underwriter. For example, in a low risk area you can insure your PC for \$6000 at a cost of \$60.70 for a full year. In a high risk area, the premium for the same policy would be \$158.77.

In low risk areas, the minimum sum insurable is \$4000, and in high risk areas, \$3000. If your PC is worth less than \$2000, GIO suggests you take out a householder's policy and include your camera, video, etc, to make up the \$3000 worth.

You can insure your data but GIO finds people rarely do, probably because of the difficulty in declaring a value on how much the lost data is worth and how much it would cost to replace.

For commercial insurance policies, GIO's minimum premium is \$127 a year for a policy which includes theft, fire and accidental damage, with breakdown optional.

If the PC is used in your home, then you must have other policies with GIO to qualify. (This includes home businesses). If the PC is insured in your business name, you don't need to have other policies with GIO. If it is mainly used in the office but taken home every so often, then it is covered for this period by this electronic equipment policy. An office must, though, be in a secure building.

If your policy includes media and data, a GIO policy of up to \$12,500 will cost you a minimum of \$100 plus \$27 fire service levy. For policies between \$12,500 and \$25,000, the rate drops from 1 per cent to .75 per cent. GIO also has an excess of \$100 plus stamp duty.

GIO has a second type of insurance for data, which calls for a policy apart from the electronic equipment for your PC. However, this is fairly pricey, with premiums at 2 per cent of the sum insured if it is between \$7500 and \$15,000, and 1.5 per cent of the sum insured above \$15,000. But GIO reports very few enquiries and say it is not the sort of business they're really seeking. (Most insurance companies are wary of heavy claims from water and fire damage).

Commercial Union Assurance, on the other hand, finds 50 per cent of its PC owning policy holders insure against data loss, and says it's not difficult to estimate the cost of regenerating it. Commercial Union's computer and electronic insurance is underwritten by its engineering department and includes malicious or accidental damage to tapes and loss from failure of land lines.

If your PC is domestic, Commercial Union does not insist you have other policies with them, but its minimum premium is \$100 which makes it rather uneconomic to insure a really modest PC.

In Queensland, Commercial Union has a special rate for storms and tempests but in other states it doesn't differentiate, except it would like you to have your premises deadlocked.

But just how likely are you to have your PC stolen? Commercial Union says that although PC theft is increasing, it's not as high as it was anticipated. But insurance assessor Alan Ford thinks PC thefts are very common, replacing videos as a favourite target, although thefts go in waves.

Ford believes that with the price of PCs falling, full maintenance can look out of proportion, but strongly advises a proper electronic insurance policy. "A lot of policies just cover theft and natural disasters but electronic insurance will cover loss of data — provided you ask."

Unfortunately, Ford says, not all insurance brokers understand electronic

insurance and a lot of people don't ask, which creates problems in the future as small business people are not always meticulous about keeping back-up files.

He believes, though, that extra insurance to cover increased cost of working and temporary hire of replacement machines is well worth it, costing only an extra \$200 or so.

Ford disagrees that it's difficult to estimate the cost of loss of data (that's what assessors are for), or that it's difficult to understand the fine print, as insurance contracts have become much more lucid lately. Most insurance companies offer this extra cover and as most of them are re-insured with one or two major companies, the wording tends to be similar.

While assessors will expect you to behave prudently with your data, and use proper back-up methods, what about prudence with the actual PC, beyond obvious things like deadlocks? Not all burglars are deterred by having to break glass.

One simple precaution at home may be to dissuade children from playing games on a PC near an open window. Even if the game doesn't come with obtrusive sound effects, children do. In a high-risk area, you might also consider a carry-in maintenance agreement to avoid repair vans arriving on your doorstep advertising you have electronic equipment on the premises.

A more exciting concept is a device from Anchor Pad which consists of a self-adhesive mat for your desktop, providing a grip equivalent to more than 3000k of pulling power. On top of the mat is an aluminium casting to which the PC is secured by four bolts. Two heavy steel rods interlock the casting to the mat, locked in place with two pick-resistant locks, making it almost impossible to dislodge the PC without damaging it.

Prices range from \$165 to secure an Apple Mac, to \$505 to pin down an IBM PC. There are 5000 currently in use in Australia.

Various models also come for attaching to typewriters, printers, and videos, and as well, Anchor Pad also provide CyLock, a device for protecting access and data.

As an insurance assessor, Ford thinks it's a prudent step, but points out that in drug-related thefts, such devices may encourage the perpetrator to smash the whole thing out of sheer frustration. But it's still better than you being the one who feels frustrated because you've forgotten to provide any protection at all against these disasters — even if it is cold, hungry cockroaches.

END

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GLOSSARY



Acoustic coupler

A device for connecting the telephone handset to data communication equipment (DCE) such as a modem linked to a computer.

ASCII

American Standard Code for Information Interchange. This character code is used for representing information by most non-IBM equipment.

Back-up copy

A duplicate copy preserved (usually) on a different volume or medium) in case of loss of the original data or program.

Basic

Beginner's Allpurpose Symbolic Instruction Code. A popular computer language invented for education purposes. An easy-to-learn, easy-to-use language, it is most similar to Fortran. It is available now on almost all microcomputer systems in varying degrees of completeness. There are often serious compatibility problems between various Basics.

Baud

The number of bits transmitted per second. Actually, the binary units of information transmitted per second. Teletypes transmit at 110 baud. Each character is 11 bits, and thus the TTY transmits 10 characters per second.

Bi-directional printing

Alternatively printing in either direction. A line printed left-to-right is followed by a line printed right-to-left. This avoids the usual carriage return delays, greatly increasing throughput.

Bios

Basic Input/Output System. A part of the operating system which manages serial peripherals.

Bit

A contraction of binary digit. A bit is an 0 or a 1. Bits are universally used in electronic systems to encode information, instructions, and data. Bits are usually grouped in larger units such as nibbles (4), bytes (8), or words (16, 24, 32, 88 or more).

Bootstrap

A program used for starting the computer, which usually clears memory, sets up I/O devices, and loads the operating system from ROM, disk or cassette.

Buffer

In hardware, a device which restores logic drive signal levels in order to drive a bus or a large number of inputs. In software, any memory structure provided ("allocated") for the temporary storage of data.

Bug

A mistake. Eliminating the mistakes from a program is known as debugging.

Byte

A group of 8 bits. A byte is universally used to represent a character. Microcomputer instructions generally require one, two or three bytes. One byte has two nibbles.

CAD

Computer-Aided Design.

CP/M

Control Program for Microcomputers. A popular single-user operating system for 8080, Z80, and 8085-based microcomputers created by Digital Research.

CPU

Central Processing Unit. The computer module in charge of fetching, decoding and executing instructions. It contains a control unit, an ALU, and other related facilities such as registers, clocks or drivers.

CRT

Cathode Ray Tube. The television tube used to display pictures or characters, and thus, by extension, a computer terminal which uses a CRT.

Cursor

A special symbol appearing on video displays which indicates the position of the next character to be inserted or deleted.

Database

A systematic organisation of data files for central access, retrieval and update.

DIP switches

A collection of small switches on a DIP, used to select options on circuit boards without having to modify the hardware.

Directory

The table of contents of a file system designed to allow convenient access to specific files.

DOS

Disk Operating System. An operating system whose main secondary storage medium is disk. It typically supplies facilities such as symbolic files, automatic space allocation, and sometimes dynamic memory allocation.

DP

Data Processing.

File

A logical body of information, with an identifying name, and considered as a unit by a user. A file may be physically divided into records, blocks, or other units as required by the memory device.

Floppy disk

A mass-storage device using a flexible (floppy) disk to record information. The diskette is permanently sealed in a square plastic jacket lined with a soft material which cleans the dis-

kettes as it rotates. A cut-out slot provides access to the moving head which must actually come in contact with the diskette surface in order to read or write. Other holes in the jacket provide access to sector holes in the diskette itself.

Full duplex

A mode of communication in which data may be transmitted and received simultaneously.

Half duplex

A mode of communication in which data may be transmitted in only one direction at a time.

Hard copy

Computer output printed on paper.

Hardware

The boards, chips, wires, nuts and bolts, etc. ie the physically existing components.

Hard disk

A disk composed of a magnetic coating applied to a rigid substratum, such as aluminium or ceramic. The term is generally used to contrast with 'soft' (floppy) disks, which are flexible but are slower and have less storage capacity.

High resolution

A quality of video graphics display systems or printers capable of reproducing images in great detail to a high degree of accuracy.

Input/Output (I/O)

Describes lines or devices used to convey information between the computer system and the outside world.

LCD

Liquid Crystal Display.

LED

Light Emitting Diode.

Letter quality

Describes printers which produce high-quality output, usually using impact methods with die-cast type.

Mass storage

The secondary, slower memory used for storing large files or large numbers of small files. Typical mass storage devices for microcomputer systems are hard disks, floppy disks, or cassette tapes.

Memory

A storage area for binary data and programs. Also: any device which will store information. In a computer, memory is divided into fast electronic memory

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GLOSSARY

integral to the computer and external, slower memory such as disk drives and tape drives, using magnetic recording methods.

Menu

A set of options or choices displayed by a program from which the user may choose.

Modem

Modulator-DEModulator. A device used to interface a digital device to a telephone line, it encodes and decodes serial bits into frequencies.

MPU

MicroProcessor Unit.

Network

A system of interconnected computers, which may take on such configurations as rings, stars, or chains.

OEM

Original Equipment Manufacturer. A manufacturer who uses computers or components as part of the package of products they sell, as opposed to end users, who buy computers for their own use and not for resale.

Operating system

The software required to manage the hardware and logical resources of a system, including device handling, process scheduling and file management.

Parallel

The processing, transmission, or storage of data in a way that all of the elements of a compound item, such as the bits in a byte, are handled simultaneously.

Peripheral

Any device connected to a computer which is to some degree controlled by the computer.

Pixel

An element of a picture, such as a dot on a video graphics display system.

Plotter

A mechanical device for drawing images under computer control.

Protocol

A set of rules governing the exchange of information between two systems.

QWERTY

The traditional typewriter keyboard layout, in which the keys for those six letters appear in one of the rows in that order.

RAM

Random Access Memory.

ROM

Read Only Memory.

RS232C

The widely used standard for connecting computer system components, especially for serial communication of control and data between computers and

serial input/output peripheral devices. Actually RS232C is an electrical standard for connecting data terminal equipment (DTEs) such as CRTs (or computers) to data communication equipment (DCEs) such as modems or network data concentrators.

Scrolling

Moving the contents of the CRT screen up or down by one or more lines.

Serial

The processing, transmission, or storage of data such that all of the elements of a compound item, like the bits in a byte, are handled sequentially. *Contrast with:* parallel.

Software

The instructions that tell hardware what to do with data, ie the programs. *Contrast with:* hardware.

VDU

Video Display Unit. The British term for CRT.

Wait state

A micro-cycle or internal state entered by an MPU when a synchronising signal is not present. It is used to synchronise a faster processor with a slow memory.

Winchester disk

A hard disk system characterised by very light read/write heads, low head-to-disk clearance, and complete enclosure of the magnetic media in a dust-free environment to achieve high information density and fast access-time.

Window

A section of a CRT screen dedicated to displaying specific types of information.

Word processor

A computer-based system for writing, editing and formatting letters, reports, and books.

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'No Jones, we're not replacing you with a computer. We're replacing you with a pocket calculator.'

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In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ... without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies around the world claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices... without lowering the quality.

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We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can... because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them... and sell them for much higher prices to you!

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Computermate Supreme diskettes have been around for years... and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Supreme diskette. And maybe more than once, you've bought a box or two or more of Supreme diskettes without knowing it. They just had some "big" company's name on them.

Supreme Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

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Computerscope, Blacktown	(02) 831 1718	Maxwell's, Abbotsford	(03) 419 6811
The Computer Place, Nth. Sydney	(02) 957 4690	Roylaine, Warragul	(056) 23 4255
The Computer Place, Bankstown	(02) 708 5843	Robbie's, Burnie	(004) 31 2560
Bracey's, Lithgow	(063) 51 2321	A & R Buss. Centre, Hobart	(002) 34 4288
Sounds Inc., Lithgow	(063) 51 2563	Birchall's, Launceston	(003) 31 3011
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Dymock's, Sydney	(02) 233 4111	Selected Grace Bros. Stores	
Computer Cavern, Miranda	(02) 525 9406		
Gray's Electrical, Singleton	(065) 72 3736		
Logical Choice, Wagga	(069) 21 5505		
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Computermate Supreme Diskettes are unconditionally warranted against defects in original material and workmanship.

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(Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)



SUPPLIER DETAILS

*Below is a list of company names and addresses mentioned throughout this guide.
Details were correct at the time of going to press.*

Anchor Pad
159 Victoria Road,
Drummoyne NSW 2047.
Tel: (02) 819 7322

Anitech (Zenith)
1-5 Carter Street,
Lidcombe NSW 2141.
Tel: (02) 648 1711

Atlantis International Computers
49 Wadham Parade,
Mt Waverley Vic 3149.
Tel: (03) 277 3139

Audio Engineers
342 Kent Street,
Sydney NSW 2000.
Tel: (02) 29 6731

Basic Time
20 Parkes Street,
Parramatta NSW 2150.
Tel: (02) 635 8877

CCA Systems (Compaq)
100 Harris Street,
Pyrmont NSW 2009.
Tel: (02) 660 0077

Communication Control
911 Beaumont Road,
Mt Kuring-Gai NSW 2080.
Tel: (02) 457 8100

Computer Corporation of Australia (Cleveland)
21-23 McLachlan Street,
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Tel: (07) 529 022

Computer Office Supplies
610 Church Street,
Richmond Vic 3121.
Tel: (03) 429 8488

Computer Print & Paper
141 Herald Street,
Cheltenham Vic 3192.
Tel: (03) 553 2100

Datacraft
221 Miller Street,
North Sydney NSW 2060.
Tel: (02) 929 7033

Data Peripherals (Televideo)
1 Lyon Park Road,
North Ryde NSW 2113.
Tel: (02) 888 5733

Dick Smith Electronics
Cnr Lane Cove & Waterloo Roads,
North Ryde NSW 2113.
Tel: (02) 888 3200

Eastern Micro Electronics
92-94 Bank Street,
South Melbourne Vic 3205.
Tel: (03) 699 3088

Epson Australia
Unit 3, 17 Rodborough Road,
Frenchs' Forest NSW 2086.
Tel: (02) 452 5222

Eracom
81-91 Military Road,
Neutral Bay NSW 2089.
Tel: (02) 908 4177

IBM Australia
100 Walker Street,
North Sydney NSW 2060.
Tel: (02) 923 5125

Intelligence Systems (Datavue)
17 Natalia Avenue,
Huntingdale Vic 3166.
Tel: (03) 543 7988

Jaymac Electronics
Factory 2, 24 Govan Street,
Seaford Vic 3198.
Tel: (03) 785 1044

Kaypro Computers Australia
Unit 2, 9-11 Ethel Road,
Kirrawee NSW 2232.
Tel: (02) 542 3866

KCM Computers (A*Star II)
380 Victoria Street,
Richmond Vic 3121.
Tel: (03) 429 2733

Mitsubishi Electric AWA (Amstrad)
348 Victoria Road,
Rydalmere NSW 2116.
Tel: (02) 638 8444

NEC Information Systems
99 Nicholson Street,
St Leonards NSW 2065.
Tel: (02) 438 3544

Olivetti Australia
140 William Street,
East Sydney NSW 2011.
Tel: (02) 358 2655

Pacific Data Corporation (Osborne)
3rd Floor, 93 York Street,
Sydney NSW 2000.
Tel: (02) 290 1122

Parity Computers
472 Pacific Highway,
St Leonards NSW 2065.
Tel: (02) 438 3222

Pulsar Electronics (Bondwell)
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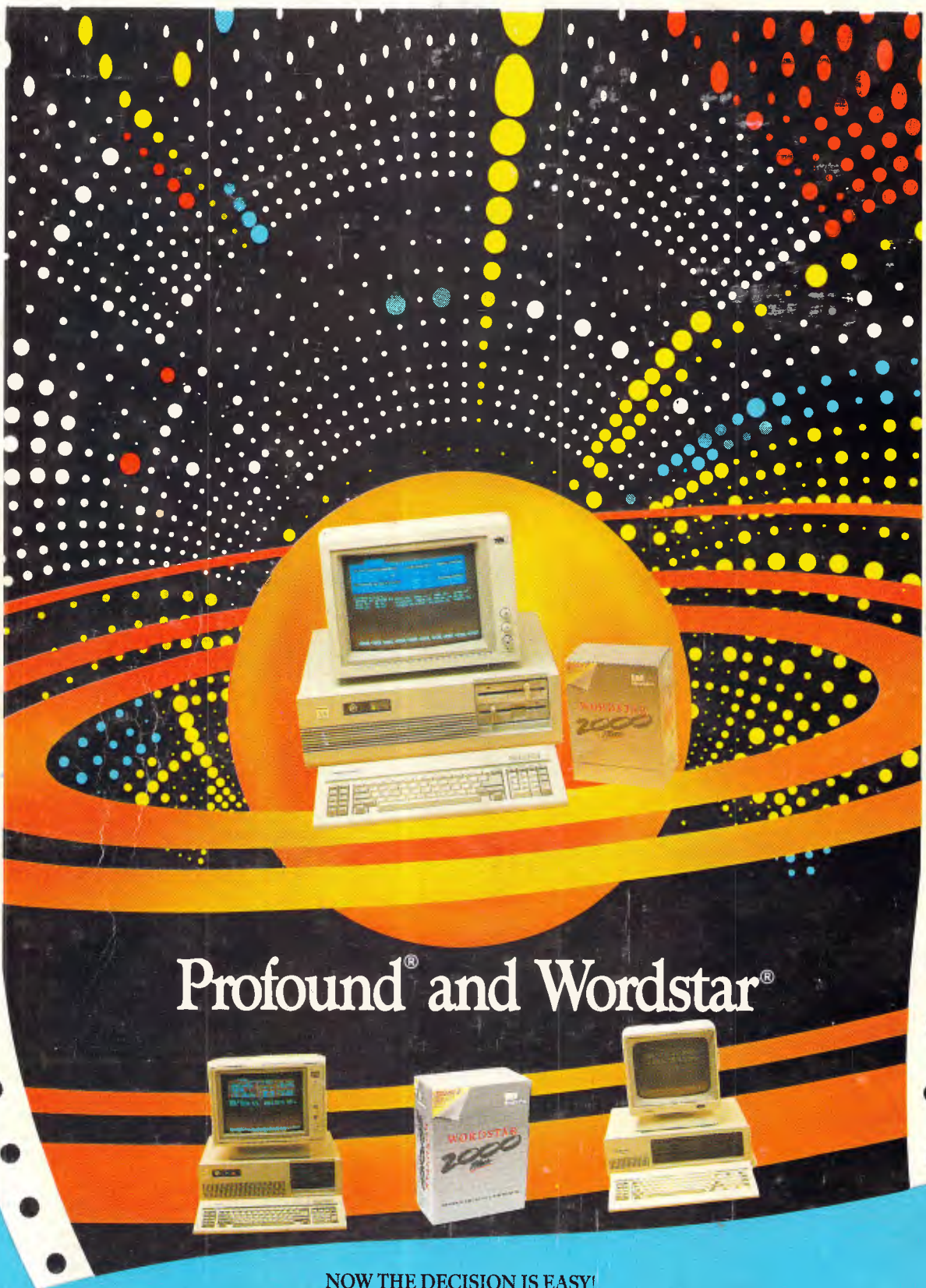
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